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L. Stejneger, 1907, 1908

* Deceased.

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VOL. XXI, PP. VII-XVIII JANUARY 28, 1909

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

PROCEEDINGS.

The Society meets in the Assembly Hall of the Cosmos Club on alternate Saturdays at 8 P. M. Brief notices of the meetings, with abstracts of the papers, are published in *Science*.

January 11, 1908 — 437th Meeting.

The President in the chair and 100 persons present.

The following communications were presented:

E. W. Nelson: Distribution of Plant and Animal Life on the Peninsula of Lower California.*

D. T. MacDougal: The Colorado River and Changes in its Basin.

January 25, 1908 — 438th Meeting.

The President in the chair and 75 persons present.

The following communications were presented:

W. P. Hay: Exhibition of Colored Lantern Slides by the Autochrome Plates.

F. V. Coville: The Probable Assimilation of Free Nitrogen by the Swamp Blueberry (*Vaccinium corymbosum*).

W. W. Stockberger: Some Problems and Possibilities in Hop Culture.

February 8, 1908 — 439th Meeting.

The President in the chair and 33 persons present.

H. W. Clark noted the occurrence and form of rain-traces on Oriental plane-trees.

The following communications were presented:

L. O. Howard: Some New Parasitic Work.

H. W. Clark: List of Plants for Aquatic Gardens.

* To be published by Biological Survey.

February 22, 1908 — 440th Meeting.

The President in the chair and 40 persons present.

The following communications were presented:

B. W. Evermann: Testing the Water of Small Lakes for Oxygen.

A. H. Howell: The Destruction of the Cotton Boll Weevil by Insectivorous Birds.*

F. V. Coville: A Mistletoe Destructive to the Douglas Fir.

March 7, 1908 — 441st Meeting.

The President in the chair and 60 persons present.

M. W. Lyon, Jr., cited a reference to alleged adaptive variation among cats and rats inhabiting warehouses.

H. W. Clark noted a case of fasciation in the hyacinth.

The following communications were presented:

W. P. Hay: Some additional Colored Lantern Slides by the Autochrome Process.

Vernon Bailey: Home Life of the Lobo or Buffalo Wolf of the Great Plains.

M. W. Lyon, Jr.: A Simple Method to represent graphically the trend of Variation in a small number of specimens of related species.†

March 21, 1908 — 442d Meeting.

The President in the chair and 30 persons present.

The following communications were presented:

W. J. Spillman: Fixation of Breed Characters in Animals and Plants.

M. C. Marsh: A New Method of Marking Salmon Fry.

M. W. Lyon, Jr.: Remarks on the Horns and the Systematic Position of the American Antelope.‡

* U. S. Dept. Agriculture, Biological Survey, Bull. No. 29, 1907; circ. No. 61, 1908.

† Contained in "Mammals collected in Eastern Sumatra by Dr. W. L. Abbott during 1903, 1906 and 1907, with descriptions of new species and subspecies." Proc. U. S. Nat. Mus. XXXIV, pp. 628–632 and text fig. 3, Sept. 11, 1908.

‡ Remarks on the horns and on the systematic position of the American Antelope. Proc. U. S. Nat. Mus., XXXIV, pp. 393–402, plates XXXVIII–XXXIX, Aug. 11, 1908.

April 4, 1908 — 443d Meeting.

Vice-President Hay in the chair and 40 persons present.

L. O. Howard noted the discovery of a new species of scale insect.

B. W. Evermann announced the successful inoculation of fishes with the glochidia of fresh water mussels.

The following communications were presented:

C. L. Marlatt: The White Fly Problem in Florida.

W. C. Kendall: Notes on Sebago Lake.

April 18, 1908 — 444th Meeting.

The President in the chair and 32 persons present.

The following communication was presented:

W. A. Murrill: Cuba and Cuban Agriculture.

May 2, 1908 — 445th Meeting.

The President in the chair and 29 persons present.

Mr. Bailey Willis outlined the plans of the Washington Academy of Sciences with reference to its proposed journal.

The following communications were presented:

Loco Weed Investigations in Field and Laboratory.*

R. H. True: Laboratory Investigations of A. C. Crawford.

C. D. Marsh: Field Investigations.

October 17, 1908 — 446th Meeting.

The President in the chair and 26 persons present.

L. O. Howard noted his observation of one individual of the common drone fly in the council room a few minutes earlier.

Miss E. G. Mitchell noted flies of the same species in a window at 14th and H streets the present evening.

T. N. Gill noted an undescribed fish (*Anomalops*) from the West Indies.

B. W. Evermann mentioned new vernacular names of fishes at Sault Ste Marie.

T. E. Wilcox referred to the use by Indians of the name tsetse for a certain fly.

* Bull. 129, Bureau of Plant Industry, 1908; Science, Oct. 23, 1908, p. 570.

H. E. Van Deman remarked on the abundance of mayflies on the shore of Lake Erie near Sandusky.

The following communications were presented:

Theo. N. Gill: Recent Discoveries in the Natural History of Eels.*

A. L. Quaintance: The Pear Thrips Problem in California.

October 31, 1908 — 447th Meeting.

The President in the chair and 30 persons present.

There were no regular communications. The evening was devoted to a discussion of the necessity for an immediate biological survey of the Isthmus of Panama.

November 14, 1908 — 448th Meeting.

The President in the chair and 25 persons present.

The following communications were presented:

Hugh M. Smith: Photography of Living Fishes.

Henry Oldys: Some Deductions from the Nesting of Birds.

Wells W. Cooke: The Earliest Migration Records in the United States.

November 28, 1908 — 449th Meeting.

The President in the chair and 55 persons present.

H. W. Clark noted the occurrence of partially buried maple seeds.

L. O. Howard noted the existence of an unknown means of distribution of the gypsy moth.

The following communication was presented:

F. Creighton Wellman: General Biological Conditions in Angola, Portuguese West Africa.

December 12, 1908 — 450th Meeting.

The meeting was held in the lecture hall of George Washington University, the President in the chair and 240 persons present.

The following communication was presented:

Ernest Thompson Seton: Two Thousand Miles by Canoe to the Arctic Region.

* Science, December 11, 1908, p. 845.

December 26, 1908 — 451st Meeting.

TWENTY-NINTH ANNUAL MEETING.

The President in the chair and 27 persons present.

The annual reports of the Recording Secretary and Treasurer were read and accepted. The following officers were elected for the year 1909 :

President : T. S. Palmer.

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Recording Secretary : M. C. Marsh.

Corresponding Secretary : W. H. Osgood.

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Councilors : A. D. Hopkins, A. K. Fisher, A. B. Baker, David White, Vernon Bailey.

The newly elected president announced the following standing committees :

Committee on Publications : W. P. Hay, W. H. Osgood, J. W. Gidley.

Committee on Communications : M. W. Lyon, Jr., J. W. Titcomb, E. A. Schwarz, C. V. Piper, N. Hollister.

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Brown, E. J. Smithsonian Institution.
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Busck, August. U. S. National Museum.
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PROCEEDINGS
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NOTES ON GENERA OF PANICEAE. II.*

BY AGNES CHASE.

The two genera, *Hymenachne* and *Sacciolepis*, discussed in the present paper, while not very closely related, have been confused because of the similarity in the form of the inflorescence of most of the species in each, a spike-like panicle.

GENUS HYMENACHNE Beauv. 1812, Agros. 48. t. 10. f. 8.

"Axis paniculatus: Panicula simplex, *spicæformis: Rami conferti.*— Glumæ inæquales, herbaceæ, acutæ: infer. multo brevior. FLOSC. INFER *neut.:* Palea infer. acuta: super. brevissima, *membranacea, hyalina.*— FLOSC. SUPER. hermaphroditus: *Paleæ herbaceæ membranaceæ* acutæ.* * * SPEC. Agrostis *myuros* Lam. *monostachya* POIR."

The illustration represents the second species mentioned by Beauvois, *Agrostis monostachya* Poir., which according to the American Code,† should therefore be taken as the type of the genus, although Beauvois gives the name *Hymenachne myuros* in the explanation of plate 10, showing that he misunderstood Lamarck's species.

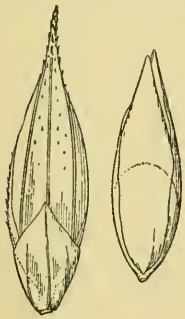

Fig. 1.
Hymenachne amplexicaulis.

Agrostis monostachya Poir. 1810, Encyc. Suppl. 1: 256. "Cette plante a été recueillie à Porto-Ricco, par M. Riedle. (*V. s. in herb. Desfont.*)"

The type labeled in Poiret's hand, "Agrostis monostachya Poir. enc. sup. Reidel Porto-Ricco," was examined by Professor A. S. Hitchcock‡ in the Desfontaine herbarium at Florence. The accompanying figure is drawn from this specimen.

Panicum myuros Lam. (incorrectly given as *Agrostis myuros* Lam.) cited by Beauvois under *Hymenachne* is not the same species as *Agrostis monostachya* Poir., as most subsequent authors seemed to think. The type of this was seen in Lamarck's herbarium in Paris,

* Notes on Paniceae I, with general discussion of the importance of the fruit as a generic character in this tribe appeared in Proc. Biol. Soc. Wash., 19: 183-192. Dec. 1906.

† Canon 15, b.

‡ All the type specimens definitely mentioned as found in the different European herbaria were examined by Professor A. S. Hitchcock in the spring of 1907.

and was found to be a congener of *Sacciolepis striata* (L.) Nash., *Panicum indicum*, and allied species.

Beauvois emphasizes the simple spike-like panicle, and also the real distinguishing character of the genus, the membranaceous lemma and palea, to which latter character the name refers, "De ὑμὴν" Membrana; "ἄχνη Palea." But, probably because he did not know Lamarck's species, Beauvois included in *Hymenachne P. myuros* which does not have a membranaceous lemma and palea. Subsequent authors have placed in the genus or section *Hymenachne* various *Panicum* allies having a spike-like panicle, but often without other similarity. It is not evident whether Beauvois considered the two species he cites synonymous or not. In the index only *Hymenachne myuros* is given; *A. monostachya* is not formally transferred and is not mentioned in the index.

Roemer & Schultes (1817, Syst. 2: 25) maintain this and others of Beauvois' new genera without comment.

Trinius (1820, Fund. Agros. 176) upholds *Hymenachne* as a genus with one species, *myurus*, though *Digitaria*, *Monachne* and other genera are included in *Panicum*. Trinius adds the note: "Obs. *Panicis maxime affinis. An hujus generis* (forte tunc *emendandi*) Andropogon insularis L.?" which seems to indicate that he gave greater weight to the membranaceous fruit than to the spike-like panicle. This is assuming that Trinius supposed *H. myurus* and *A. monostachya* to be synonyms. Later (1826. Gram. Pan. 51) Trinius places *Hymenachne* together with *Trichachne*, *Setaria*, *Pennisetum* and other genera in *Panicum* under the following synoptical division "e) Thyrsus (simplex vel compositus), aut Racemi compositi longe plerumque sparsi et jubati. Spiculæ oblongæ l. lanceolatæ, pl. min. inæqualiter dispositæ. Gluma inferior manifesta (*Jubaria*).*)" ["*Species quarum radii, quantumvis racemos mentientes, radiolos, distinctos emittunt, ad sectionem sequentem Miliariam referuntur."] This gives a wholly artificial grouping based solely on the narrow panicle and includes *Chætochloas*, various true *Panicums* and allies. *Jubaria* (l. c. p. 159–183) is subdivided into four groups, the third of which, "* * * Thyrsi pl. min. compositi spiculæ basi nudæ (absque involucello)" includes *Panicum indicum* L., *P. viroides* Trin., *P. gibbum* Ell. (which belong in *Sacciolepis*), and *P. amplexicaule* Rudge (true *Hymenachne*) under which *Hymenachne myuros* Beauv. and *Panicum myuros* Kunth "(nec Lam.)" are given as synonyms. Trinius observes "Lamarckii gramen, cui 'folia angusta, convoluta' certe huc non pertinet." But *Panicum myuros* Lam. and *P. amplexicaule* continued to be considered synonymous by other authors. Under his fourth division of *Jubaria* Trinius includes *Panicum palustre* Trin. (a true *Hymenachne* having a racemose panicle) between *Panicum leucophæum* Kunth (which is *Valota*) and *P. plicatum* Lam., which belongs in section *Ptycophyllum* of *Panicum*. These details are given only to show that the cause of confusion was the form of the inflorescence.

Nees (1829, Agros. Bras. 273) recognizes *Hymenachne* as a genus, but like Trinius groups with it the allies of *Panicum gibbum* Ell., though he places the following observation after them: "Hac in specie ac in præce-

dente [*H. fluviatilis*, which is the same as *Panicum vilvoides* and *H. campestris*] flosculus hermaphroditus glumis et neutro flosculo brevior est multo, non vero herbaceus ut in *H. myuro*, sed subcartilagineus." *Panicum paludicola* Nees, a *Hymenachne*, and *P. striatum* Lam., a *Sacciolepis*, are given among true *Panicums*.

Desvaux (1831, Opus. 82) transfers *Agrostis monostachya* Poir. to *Panicum*, changing the name to *P. Hymenachne* Desv. He observes that this plant had been confounded with Agrostis [Panicum] myuros, which was very different.

Kunth (1833, Enum. Pl. 1: 86) under division 5 includes a miscellaneous group of *Sacciolepis*, *Hymenachne*, *Eriochloa* and other allies, as well as several species of *Panicum* itself.

Trinius (1883, Pan. Gen. 165) includes about the same group under his section *Virgaria* of *Panicum*.

Nees (1841, Fl. Afr. Aust. 50.) makes a section *Curviflora* of *Panicum* for two species of *Sacciolepis*.

Steudel (1854, Syn. Pl. Glum. 2 : 101) includes in the genus *Hymenachne* four names referable to *Sacciolepis*, and two (which are, however, synonyms) to *Hymenachne;* a seventh species, which is probably a *Sacciolepis*, he includes with the mark of doubt.

Grisebach (1864, Fl. W. I. 553) includes in the genus *Hymenachne* one species which belongs there and two which belong to *Sacciolepis*.

Doell (1877, Mart. Fl. Bras. 2^2: 231) in the first part of the section *Miliaria* of *Panicum* gives seven species, five of which are referable to *Sacciolepis*, one to *Hymenachne*, and one probably to *Steinchisma*. *Panicum auriculatum*, a *Hymenachne* with ascending, not oppressed, panicle branches, is placed in the second part of the section in which most of the species are true *Panicums*. It is worthy of note that Doell uses the name *Panicum myuros* Lam. for the species to which the type really belongs, stating that he saw the specimen in the Paris Museum. Under *Panicum amplexicaule* Rudge, he straightens out the hitherto confused synonomy of this species.

Bentham (1878, Flora Australiensis 7: 465) makes a section *Myuroideæ* of *Panicum* under which he places three species, two of which belong in *Sacciolepis* and one in *Hymenachne*.

Fournier (1881, Mex. Pl. 2: 36) includes eight species in the genus *Hymenachne*, two of which are referable to *Sacciolepis*, three to *Hymenachne*, and two to *Panicum*. The remaining species, *H. Gouini* Fourn., unknown to us, is probably a *Hymenachne*.

Hackel (1887, Engler & Prantl. Pfl. Fam. 2^2: 35) recognizes *Hymenachne* as a section of *Panicum* with spike-like panicles and slightly indurated glumes. No species are mentioned.

Hooker (1896, Fl. Brit. Ind. 39) places seven species under *Hymenachne* as a section of *Panicum*, three of which are referable to *Hymenachne* and four to *Sacciolepis*.

Stapf (1898, Flora Capensis 386) makes a section *Vilfoideæ* for three species referable to *Sacciolepis*.

Description.—Spikelets short-pediceled, crowded in slender racemes

which are erect, forming a dense spike-like panicle, or narrowly ascending; spikelets lanceolate, acuminate; first glume ⅓ to ½ as long as the spikelet, remote, a distinct stipe below the second glume; sterile lemma 5-nerved, acuminate, exceeding the lanceolate stramineous fruit; lemma and palea membranaceous, margins of the lemma thin (not broad and hyaline), not enrolled; palea not inclosed above; grain oblong, at maturity readily falling from the open lemma and palea. Perennial aquatic or semi-aquatic grasses, decumbent at base and rooting at the lower nodes, with rather stout simple stems and long lanceolate blades cordate-clasping at base, except in *Hymenachne montana*. Species seven or eight, confined to the tropics and subtropics.

**Panicles elongated, spike-like.*

Hymenachne amplexicaulis (Rudge) Nees 1829, Agrost. Bras. 276, based on the next.

Panicum amplexicaule Rudge 1805, Pl. Guian. 1: 21. t. 27. Type "ex herb. Rudge" in the British Museum.

Agrostis monostachya Poir. 1810, Encyc. Suppl. 1: 256. (See note above on type.)

Panicum Hymenachne Desv. 1831, Opus. 82. Based on *Agrostis monostachya* Poir.

Panicum myuros of authors not Lam.

In the tropics and subtropics of western hemisphere.

Hymenachne patula Fourn. 1881, Mex. Pl. Gram. 37. "Bejucal in insula Cuba (Liebm. n. 402.)"

A specimen of this number from Fournier is in the herbarium of the Botanical Garden at Copenhagen. The panicle is less dense than in the preceding.

Known only from Cuba.

Hymenachne pseudo-interrupta C. Muell. 1861, Bot. Zeit. 19 : 333. "India orientalis, Bengalia et Malacca. Griffith."

Specimens in the National Herbarium from India, Malacca and Java answer to Mueller's description. They differ from *H. amplexicaulis* in having blades narrowly cordate at base, long-attenuate or involute above; and in the longer spikelets with longer-pointed glumes. Nees' description of *P. auritum* Presl (ex Nees 1829, Fl. Bras. 2: 176) seems to apply to this species, but we have not seen the type of either.

Hymenachne montana Griseb. 1879, in Goett. Abh. 24 : 307. "C ["C = Prov. Cordoba und Santiago del Estero." l. c. 4.] S. Achala." The type is in Grisebach's herbarium at Göttingen, labeled "Achala, Hieronymus 640."

An anomalous species, bearing about the same relation to the typical species that *Panicum Chapmanii* Vas. and related forms bear to *Eupanicum*. A few of the lower spikelets are subtended by a scabrous bristle (a sterile pedicel); first and second glumes sub-equal, much shorter than the sterile and fertile lemmas; fruit as in the type species, except that it is slightly indurated.

Argentina.

***Panicle long and narrow with ascending branches, not spike-like.*

Hymenachne auriculata (Willd.).

Panicum auriculatum Willd. 1825, ex Spreng. Syst. 1 : 322. "Amer. austr." The type, labeled "Amer. merid. Humboldt," is in the Willdenow herbarium, Berlin.

Panicum polystachyum Presl 1830, Rel. Haenk. 1: 312. "Hab. in Peruvia." (Not *P. polystachyum* Schult. 1824, Mant. 2: 146.) The type, in the Presl herbarium in the National Museum, Prag, is labeled "Regno montana, Peru."

Brasil and Peru.

Hymenachne palustris (Trin.).

Panicum palustre Trin. 1826, Gram. Pan. 181. "V. spp. Brasil. (Langsdorff.)" The type bearing the label "Panicum palustre m. Brasil Langsdorff. In fossis serra dos Orgonos," is in the Trinius herbarium, in the St. Petersburg Academy of Sciences.

Panicum paludicola Nees in Trin. l. c. as synonym sub *P. palustre*; 1829, Agros. Bras. 179. The specimen in Trinius' herbarium is cited and *Panicum palustre* Trin. is given as synonym.

In the Icones 2, *pl. 218*, Trinius reduces *P. palustre* to a synonym of *Panicum frondescens* Meyer, but from Meyer's description and a specimen from Brasil determined by Nees this seems to be a species related to *Panicum stoloniferum* Poir. Plate 218 is drawn from a Brasil specimen, and agrees with the specimens of *P. palustre* in Trinius' herbarium.

Panicle less dense than in the preceding, spikelets larger.

Brasil.

Two species represented in the National Herbarium, one from Uruguay and one from the Philippines, remain to be identified with published names or to be described.

The following species should be excluded from *Hymenachne*, to which genus they have been referred by various authors:

Hymenachne boiviniana Steud. . . . . = Sacciolepis?
Hymenachne campestris Nees . . . . . = Sacciolepis.
Hymenachne fluviatilis Nees. . . . . = Sacciolepis.
Hymenachne frondescens (Meyer) Fourn. . . = Panicum.
Hymenachne indica (L) Buese . . . . = Sacciolepis.
Hymenachne interrupta (Willd.) Buese . . = Sacciolepis.
Hymenachne leptostachya (Presl) Fourn. . . = Panicum?
Hymenachne myosuroides (R. Br.) Balansa = Sacciolepis.
Hymenachne myosurus (Rich.) Nees . . . . = Sacciolepis.
Hymenachne myuros (Lam.) Beauv. . . = Sacciolepis.
Hymenachne phalaroides (R. & S.) Nees . . = Sacciolepis?
Hymenachne phleiformis (Presl) Fourn. . . = Sacciolepis.
Hymenachne polymorpha Balansa . . . . . = Sacciolepis?
Hymenachne striata (Lam.) Griseb. . . . . = Sacciolepis.

None of the above species is here transferred.

GENUS SACCIOLEPIS NASH 1901, BRITT. MAN. 89.

"A perennial grass with flat leaves and a terminal contracted panicle. Spikelets numerous, readily deciduous when mature, 1-flowered, articulated to the pedicel below the empty scales. Scales 4, the outer 3 membranous, the first scale small, the second one much larger than the rest, many-nerved, strongly saccate at the base; fourth scale much shorter than the third, chartaceous, enclosing a palet of similar texture and a perfect flower. * * * [Greek, in reference to the large saccate second scale of the spikelet.]."

The only species given under the genus is *Sacciolepis gibba* (Ell.) Nash (l. c.), based on the following:

Panicum gibbum Ell. 1817, Sk. Bot. S. C. and Ga. 1: 116. No specimen is cited. The type in the Elliott herbarium in the College of Charleston, consists of a single culm with three leaves and an over-mature panicle. The label in Elliott's writing reads: "Panicum gibbum mihi. flor. Aug. Sept. Car. Georg. in locis udis."

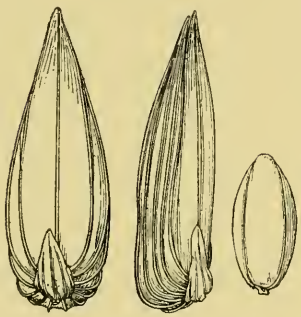

Fig. 2.
Sacciolepis gibba.

Nees (1841, Fl. Afr. Aust. 50) establishes a division *Curviflora*; Bentham (1878, Fl. Austral. 7: 480) a series *Myuroideæ*; and Stapf (1898, Flora Capensis 386) a section *Vilfoideæ* for species referable to this genus. For the history of the disposition of this group by various authors, see the notes under *Hymenachne*.

Description.—Spikelets short-pediceled on short usually erect racemes forming dense spike-like panicles (except in *P. curratum* L.), spikelets oblong-conical; first glume small, second glume broad, inflated-saccate, strongly many-nerved; sterile lemma narrower, flat, fewer-nerved, its palea nearly as long, often subtending a staminate flower; fruit stipitate, elliptical, the lemma and palea chartaceous-indurated, the margins of lemma inrolled, the palea not enclosed at the summit. Grasses of wet ground; culms usually branching, and rooting at the lower nodes.

SACCIOLEPIS STRIATA (L.) Nash 1903, Bul. Torr. Bot. Club, 30: 383.

Holcus striatus L. 1753, Sp. Pl. 1048. "Habitat in Virginia paludibus." The type in the Linnean herbarium is "a Gronovius plant numbered 59, upon which Linnaeus has written '7 striatus.'"*

Panicum striatum Lam. 1791, Tab. Encyc. 1: 172. "Carolina. Com. D. Fraser." The type labeled "de la Caroline, fraser, panicum striatum lam." is in the Paris herbarium. Though the same specific name is used it appears that Lamarck did not know *Holcus striatus* L.

Panicum gibbum Ell. 1817, Sk. Bot. S. C. and Ga. 1: 116. (See above.)

Panicum Elliottianum Schult. 1824, Mant. 2: 256. Based on the preceding, the name being changed because of *P. gibbosum* Brown.

* Fide Hitchcock, in note book.

Panicum aquaticum Bosc ex Spreng. 1825, Syst. 1: 319. "Ins. Bermud." A duplicate type was seen in the Webb herbarium in Florence.

Sacciolepis gibba (Ell.) Nash 1901, Britt. Man. 89. (See above.)

Sacciolepis myuros (Lam.)

Panicum myuros Lam. 1791, Tab. Enc. 1: 172. (Misprinted "myruos," but corrected in Enc. 4: 748.) "Ex America merid. Comm. à D. Richard." The type in the Lamarck herbarium in Paris is labeled in Lamarck's handwriting "de Cayenne Leblond Panicum myuros lam. ill. gen." In the Encyclopédie (4: 748) the specimen is said to come from Cayenne, communicated by Richard and Leblond.

Fig. 3. *Sacciolepis myuros.*

Since this species has been so generally misunderstood a spikelet from the type is illustrated here to show the generic relationship.

Panicum myosurus Rich. 1792, Act. Soc. Hist. Nat. Par. 1: 106. No specimen is cited, but the name is published with a brief diagnosis in a "Catalogus plantarum * * * e Cayenna missarum a Domino Le Blond." The type is in the Paris herbarium. It is a somewhat larger specimen than the preceding type.

This species is represented in the National Herbarium by *Liebmann Mex. Gram. No. 146.*

?*Panicum phleiforme* Presl 1830, Rel. Haenk. 1: 302. "Hab. in Mexico." There are two specimens on the sheet labeled "Panicum phleiforme nov. sp. J. S. Presl" in the National Museum at Prag, one ticketed Mexico, the other Luzon. The Mexico specimen is small and slender, but may be referable to *S. myuros;* the spikelets agree with those of Lamarck's specimen, except that they are less acute. *Pringle 2363*, Jalisco, Mex., distributed as *P. indicum* L., seems to be the same as Presl's specimen. More material may show this form to be distinct.

Sacciolepis vilvoides (Trin.).

Panicum vilvoides Trin. 1826, Gram. Pan. 171. "Hymenachne fluviatilis N. ab Es! in Mart. Fl. Bras. ined. V. spp. Gujan. Brasil. (Fischer N. ab Esenb.)" In the Trinius herbarium there are two specimens in the cover marked "Panicum vilvoides m." One is labeled "Panicum vilvoides m. Hymenachne fluviatilis N. ab Es. sub quo nom. mis in Brasil. lectu an. N. ab." The other is labeled "Panicum (Hymenachne) vilvoides Trin. Guyan française." Fischer's name does not appear on either. Since Trinius indicated by "m" or "mihi" the specimen he named, the first specimen mentioned above may be taken as the type. The second specimen is *S. myuros.*

Hymenachne fluviatilis Nees 1826, in Trin. (l. c.) as synonym sub Panicum vilvoides Trin. 1829, Fl. Bras. 273 "Panicum vilvoides Trin. in litt., ex Herb. cl. Fischeri." is cited.

This species is represented in the National Herbarium by *Edwall 1066* S. Paulo, Brasil. Other specimens apparently belonging to the same species have spikelets hirsute at the summit.

Sacciolepis strumosa (Presl).

Panicum strumosum Presl 1830, Rel. Haenk. 1: 303. "Hab ad Monte-Rey Californiæ." The type in the Presl Herbarium is labeled "Panicum strumosum nov. sp. J. S. Presl"; a second slip reads "Regno montanæ, Haenke." The published locality is clearly a mistake; no species of this group have been found in California. This species is represented in the National Herbarium by *Burchell 4420*, Brasil.

Sacciolepis indica (L.)

Aira spicata L. 1753. Sp. Pl. 63. "Habitat in India." In the Errata at the end of Vol. 2 "spicatum" is changed to "indicum," presumably because of another *Aira spicata* on page 64. "The specimen in the Linnean herbarium is a delicate creeping or spreading plant with many spikes about 1 cm. long with only a few spikelets"—[Hitchcock in notebook]. It is labeled in Linnaeus' hand "Panicum indicum." *Aira* has been scratched, and *indica* changed to *indicum*.

Aira indica L. 1753, Sp. Pl. in Errata; 1762, Sp. Pl. ed. 2, 94.

Panicum indicum L. 1771, Mant. 2: 184. Based on "Aira indica Sp. plant 94" (the reference is to the second edition).

Hymenachne indica (L.) Buese 1854, in Miq. Pl. Jungh. 377. Based on *Panicum indicum* L.

Of the several species in the National Herbarium from India received as *Panicum indicum* L., that represented by *Duthie 10,003* from the herbarium of Prof. Hackel seems to be the true *P. indicum*.

Sacciolepis curvata (L.).

Panicum curvatum L. 1767, Syst. Nat. ed. 12: 732. "Habitat in Suratte."

?*Panicum coryophorum* Kunth 1831, Rev. Gram. 2: 387. t. 107. "Crescit in Madagascaria." Communicated by Aubert du Petit-Thouars. Kunth remarks that while the description of *P. curvatum* L. might include his species, it is nevertheless too brief to convince him of the identity of the two, especially since one is from India and the other from Madagascar. The Madagascar specimen in the National Herbarium agrees perfectly with Kunth's figure, but the identity of *P. curvatum* L. and *P. coryophorum* Kunth can only be determined by a study of the types. The two are considered synonymous by Hooker, Stapf and others. This is the only known species with an open panicle. The spikelets closely resemble those of the type species, *S. gibba*.

The following species which belong in this genus are not here transferred for lack of complete data:

Panicum rigidifolium Trin. 1829, Sp. Gram Ic. 2. t. 214. "Figura ad specimen Brasiliense." The type in Trinius herbarium, St. Petersburg, is labeled "Panicum rigidifolium m. 4 Brasil. Langsdorff."

This is an outstanding species with a fruit larger in proportion to the size of the spikelet than in any other species. It is not here transferred because of uncertainty as to the oldest tenable name. Kunth (1833, Enum. Pl. 1: 88) changes the name of *P. rigidifolium* Trin. to *Panicum*

Trinii Kunth because of *P. rigidifolium* (Poir.) Kunth (May 2,* 1829, Rev. Gram. 1: 37). Both names thus date from 1829, and we have not been able to ascertain which is the earlier. An older name than either may apply to this species. Doell (1877, Mart. Fl. Bras. 2^2 : 236) uses *Panicum diœcum* Spreng. (1825, Syst. 1 : 322) for this species, citing "*Panicum melicoides Nees ab Esenb. secundum specimena authentica, vix Poiret.*" Sprengel's description is very brief, and does not seem to apply to this species; the spikelets are said to be diœcious and the leaves lanceolate. The native country is indicated as unknown, and "P. melicoides et poæforme Poir." are cited as synonyms. Nees (1829, Agros. Bras. 191) describes this species under *Panicum melicoides* Poir., giving *Panicum diœcum* Spreng. as a synonym. Since Nees might be expected to have seen Sprengel's specimen it may be that Sprengel's name belongs to this plant, notwithstanding the inapplicable description. The original description of *P. melicoides* Poir. (1816, Encyc. Suppl. 4: 283) could hardly apply to this species. Neither the type of this nor of *P. diœcum* has been seen.

Two other Brasilian species, *Hymenachne campestris* Nees (of which *Panicum camporum* Kunth is a typonym) and *P. caudatum* Salzm.; and *Panicum interruptum* Willd., of India, and a number of other old-world species of this group are not well enough known to us to be transferred here.

* Fide Sherborn and Woodward in Journ. Bot. 39 : 205. 1901.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

DATES OF THE SIGNATURES OF THE "MEMOIRES DE L'ACADEMIE IMPERIALE DES SCIENCES DE SAINT-PETERSBOURG. SERIES VI. SCIENCES MATHEMATIQUES, PHYSIQUES ET NATURELLES."

BY P. L. RICKER.

A few years ago the author found it necessary to determine the exact dates of publication of several of the botanical parts of the above series. Original signatures of a number of these parts were found in the various Washington libraries, in green covers with the month of publication printed on the inside of the front cover, indicating that some of the parts at least were published from one to five years before the date on the title page of the bound volume.

The results of extensive search show that covers to only about half of the signatures of this series are apparently available in this country. The private library of Mr. A. S. Hitchcock assisted in some instances, and on his visit to the St. Petersburg Academy in 1902 he secured the assistance of Mr. D. I. Litwinow, curator of the Botanical Museum of the Academy, in an effort to complete the missing dates; but he was unable to get any additional dates from the Academy records or sets. As a last resort, Mr. B. B. Woodward, of the British Museum of Natural History, who has done considerable work of this nature, was appealed to, and to him and the British Museum authorities, who have preserved all of their signature covers of this series with dates of receipt of many of them, thanks are here extended for valuable assistance in completing the dates and verifying all of those obtained by the author.

Vol.	Sect.	Livr.	Pages.	Pls.	Bull. Scientifique. No.	Bull. Scientifique. Pages.	Bull. Scientifique. Plates.	Date of Signature.	Seen at Library.
1:		1	1–116	1	Not numbered	I–X	0	Jan., 1830	A. S. Hitchcock.
		2	117–220	3		XI–XX	0	June, 1830	Bost. Soc. Nat. Hist.
		3	221–342	5		XXI–XXVIII	0	Sept., 1830	Phil. Acad. Nat. Sci.
		4	345–462	1		XXIX–LII	2	Dec., 1830	" " " "
		5	463–586	1		. . . . .	. . . .	Feb., 1831	" " " "
		6	587–698	11		LIII–LVI	1	July, 1831	" " " "
			T. P. Ind. & Cont. . .			. . . . .	. . .	Sept., 1831	
2:		1	1–102	2	1	I–XIV	0	Mar., 1832	Brit. Mus. Nat. Hist.
		2	103–218	9	2	I–XXIV	0	Aug., 1832	" " " "
		3	219–338	9	3	I–XIV	1	Oct., 1832	Bost. Soc. Nat. Hist. & A. S. H.
		4	339–458	1	4	I–XIV	0	Jan., 1833	" " " "
		5	459–568	15	5	I–VIII	1	June, 1833	" " " "
		6	569–676	2	6	I–XII	0	Oct., 1833	
			T. P. Ind. & Cont. . .		. .	. . . . .	. . . .	Nov., 1833	Smithsonian Inst.
			Sciences Mathematiques et Physiques, Vol. 1.						
3^1:		1	1–128	1	1	I–XVI	1	July, 1835	Phil. Acad. Nat. Sci.
		2	129–232	0	2	I–II *	0	Aug., 1835	Brit. Mus. Nat. Hist.
		3	233–340	2	3	XIX–XXXVI	2	May, 1836	Phil. Acad. Nat. Sci.
		4	341–438	2	. .	. . . . .	. . . .	Dec., 1836	" " " "
		5	439–526	2	. .	. . . . .	. . . .	Oct., 1837	" " " "
		6	527–600	1	. .	. . . . .	. . . .	June, 1838	
			T. P. Ind. & Cont.						
			Sciences Naturelles, Vol. 1.						
3^2:		1	1– 88	10	. .	No longer issued with the memoirs.		June, 1834	Phil. Acad. Nat. Sci.
		2–3	89–356	1	. .			" 1834	" " " "
		4	357–442	17	. .			Jan., 1835	
		5	443–544	16	. .			July, 1835	Brit. Mus. Nat. Hist.
		6	545–640	12				Aug., 1835	Phil. Acad. Nat. Sci.
			T. P. Ind. & Cont.						

			Sciences Mathematiques et Physiques, Vol. 2.			
4^1:		1–2	1–214	0	Mar., 1838	Brit. Mus. Nat. Hist.
		3	215–308	0	Oct., 1839	" " " "
		4	309–422	0	Apr., 1840	" " " "
		5–6	423–674	5	Dec., 1840	" " " "
			T. P. Ind. & Cont.		Apr., 1841	Smithsonian Inst.
			Sciences Naturelles, Vol. 2.			
4^2:	Botanique	1	1–108	0	Mar., 1836	Phil. Acad. Nat. Sci. & A. S. H.
		6	109–142	8	" 1838	Bost. Soc. Nat. Hist.
	Zoologie et Physiologie	2	1– 96	8	Sept., 1836	Phil. Acad. Nat. Sci.
		3	97–236	1	Feb., 1837†	" " " "
		4–5	237–412	35	" 1838	Bost. Soc. Nat. Hist.
			T. P. Ind. & Cont.		Mar., 1838	" " " "
			Sciences Mathematiques et Physiques, Vol. 3.			
5^1:		1	1–124	0	Oct., 1842	Brit. Mus. Nat. Hist.
		2	125–326	0	June, 1843	" " " "
		3–6	327–622	0		
			T. P. Ind. & Cont.		Apr., 1844	Smithsonian Inst.
			Sciences Naturelles Vol. 3.			
5^2:	Botanique	3	1– 90	22	Oct., 1839	Brit. Mus. Nat. Hist.
		4	91–190	18	Feb., 1840	U. S. Dept. Agr.
	Zoologique et Physiologique	1–2	1–238	22	Apr., 1839	Brit. Mus. Nat. Hist.
		5–6	239–426	22	Oct., 1840	" " " "
			T. P. Ind. & Cont.			

* No. II was paged I and II and should have been XVII and XVIII.

† The date on the outside cover of this signature is erroneously given as 1836.

Vol.	Sect.	Livr.	Pages.	Pls.	Bull. Scientifique. No.	Bull. Scientifique. Pages.	Bull. Scientifique. Plates.	Date of Signature.	Seen at Library.
			Sciences Mathematiques et Physiques, Vol. 4.						
6^1:		1	1–108	3				May, 1841	Brit. Mus. Nat. Hist.
		2	109–206	0				Nov., 1845	" " " "
		3–4	207–518 + T. P. Ind. & Cont.	2				Oct., 1850	" " " "
	Appendice météorologique	5–6	1–144	0				July, 1848	" " " "
			Sciences Naturelles, Vol. 4.						
6^2:	Botanique	1–2	1–156	4				Nov., 1840	U. S. Dept. Agr.
		3–4	157–390	16				June, 1841	Brit. Mus. Nat. Hist.
	Zoologie et Physiologie	5	1–78	17				Sept., 1841	" " " "
		6	79–194	10				May, 1845	" " " "
			T. P. Ind. & Cont.					July, 1845	Smithsonian Inst.
			Sciences Mathematiques et Physiques, Vol. 5.						
7^1:		1–2	1–202	0				June, 1848	Brit. Mus. Nat. Hist.
		3	203–302	2				Nov., 1849	" " " "
		4	303–406	0				May, 1850	" " " "
		5–6	407–548 + T. P. Ind. & Cont.	0				Apr., 1853	" " " "
			Sciences Naturelles, Vol. 5.						
7^2:	Botanique	1–2	1–190	0				Mar., 1843*	Mo. Bot. Gard.
		3	191–298	8				" 1846	Brit. Mus. Nat. Hist.
	Zoologie et Physiologie	4	1–160	5				June, 1846	" " " "
		5–6	161–416 + T. P. Ind. & Cont.	25				Nov., 1849	" " " "
									Smithsonian Inst.

		Sciences Mathematiques et Physiques, Vol. 8.				
8^1:		1–568	13	1857		Smithsonian Inst., and Brit. Mus. Nat. Hist.
		Sciences Naturelles, Vol. 8.				
8^2:	Zoologie et Physiologie 1–2	1–216	17	Feb., 1848		Brit. Mus. Nat. Hist.
	Zoologie et Physiologie 4	217–328	4	sic Nov., 1849		" " " "
	Zoologie et Physiologie 5–6	329–610	21	Aug., 1849		" " " "
	Botanique 3	1– 84	1	Mar., 1849		" " " "
		T. P. Ind. & Cont.		Oct., 1849		Smithsonian Inst.
		Sciences Mathematiques et Physiques, Vol. 9.				
9^1:		1–600	37	Dec. 15, 1858		Smithsonian Inst.
		Sciences Naturelles, Vol. 9.				
	Zoologie et Physiologie	1–366	19	Nov., 1855		Smithsonian Inst.
	Botanique	1– 82	9			
		Sciences Mathematiques et Physiques, Vol. 10, never issued.				
10^2:		Sciences Naturelles, Vol. 10.				
		1–346	16	Sept., 1859		Smithsonian Inst.

* Author's separate issued 1842!

As some of the botanical parts have been cited by the titles of the articles, these titles with their correct pagination and dates are also given.

List of Botanical Articles in the Above Series.

1: 54–93. Graminum genera quaedam speciesque complures definitionibus novis illustravit, C. B. Trinius. Jan., 1830.

1: 353–416. Same title and author as above. (Continued.) Dec., 1830.

2: 601–655. Essai monographique sur les espèces D'Eriocaulon du Brésil, par M. Bongard. pls. 1–10. July, 1831.

2: 119–177. Observations sur la Végétation de L'Ile de Sitcha, par M. Bongard. pls. 1–7. Aug., 1832.

2: 219–237. Essai Monographique sur les espèces D'Eriocaulon du Brésil, [continued] par M. Bongard. pls. 11–19. Oct., 1832.

2: 239–337. Andropogineorum genera speciesque complures definitionibus novis; illustravit C. B. Trinius. Oct., 1832.

3^2: 69–83. Generis Lacis revisio speciesque nonnullae novae adnexa est Philocrena, Genus e Podostemonearum ordine novum. Auctore H. G. Bongard. pls. 1–6. June, 1834.

3^2: 85–87. Observation sur le Sedum verticillatum L. par M. Bongard. pl. 1. June, 1834.

3^2: 89–346. Panicearum genera retractavit speciebusque compluribus illustravit C. B. Trinius. 1 pl. [not numbered]. June, 1834. This was reprinted and repaged 1–267. 1834.

3^2: 545–560. Essai Monographique sur les espèces D'Eriocaulon du Brésil, [continued]. Par M. Bongard. pls. 20–27. Aug., 1835.

3^2: 613–636. Bambusaceas quasdam novas describit C. B. Trinius. Aug., 1835. This was reprinted and repaged from 1–17.

4^2: 1–108. Graminum in hisce actis a se editorum generibus ac speciebus supplementa addit C. B. Trinius. Mar. 1836. This is a supplement to the first two articles cited in this paper.

4^2: 109–136. Bauhiniae et Pauletiae, especies Brasiliensis novae. Auctore H. G. Bongard. pls. 1–7. Mar., 1838.

4^2: 137–142. Genera duo e Melastomacearum ordine novae. Auctore H. G. Bongard. 1 pl. [not numbered]. Mar., 1838.

5^2: 1–8. Plantae quatuor Brasiliensis novae. Auctore H. G. Bongard. pls. 1–4. Oct., 1839.

5^2: 9–29. Essai Monographique sur les espèces d'Eriocaulon du Brésil, [continued] par M. Bongard. pls. 28–35. Oct., 1839.

5^2: 31–45. Compositae Brasiliensis novae. Auctore H. G. Bongard. pls. 1–9. Oct., 1839. Reprinted as "Descriptiones plantarum novarum." 1–15. 1839.

5^2: 47–90. Phalarideae. Auctore C. B. Trinius. Oct., 1839.

5^2: 91–165. Bambuseas Monographice exponit J. F. Ruprecht. pls. 1–18. Feb., 1840.

5^2: 167–189. Genera Graminum exposuit C. B. Trinius. IV. Oryzea. Feb., 1840. This was reprinted and repaged 1–23. 1840.

6^2: 1–22. Das Alyssum minutum und die zunaechst verwandten arten, monographisch bearbeitet und durch abbildungen erlaeutert; nebst einer uebersicht der arten der gattung Psilonema. Von C. A. Meyer. pls. 1–2. Nov., 1840.

6^2: 23–134. Genera Graminum exposuit C. B. Trinius. V. Agrostidea. Nov., 1840. This was reprinted as "Agrostidea I. Vilfea." 1–112. 1840.

6^2: 135–151. Einige bemerkungen ueber die Natürliche Familie der Polygonaceae. Erster artikel: Versuch einer naturgetreuen anordung der gattungen dieser familie. Von C. A. Meyer. pl. 1. Nov., 1840.

6^2: 153–156. Uwarowia chrysanthemifolia Bunge, descriptione et icone illustrata. Auctoribus F. E. L. Fischer et C. A. Meyer. pl. 1. Nov., 1840.

6^2: 157–246. Verzeichniss der im jahre 1838 am Saisang-nor und am irtyrch gesammelten Pflanzen. Ein zweites supplement zur Flora Altaica. Angefangen von Dr. G. H. Bongard, beendiget von Dr. C. A. Meyer. pls. 1–16. June, 1841.

6^2: 247–390. Gramina Agrostidea, II callus rotundus (Agrostea). Exposuit C. B. Trinius. This was reprinted as "Agrostidea, II. Callo rotundo (Agrostea)." 1–144. June, 1841.

7^2: 1–189. Gramina Agrostidea, III. Callus obconicus. (Stipacea.) Exposuit C. B. Trinius et F. J. Ruprecht. Mar., 1843. This was issued in advance as "Species Graminum Stipacearum." 1–189. 1842.

7^2: 191–223. Über einige Cornus-Arten, aus der abtheilung Thelycrania. Von C. A. Meyer. March, 1846.

7^2: 225–298. Versuch einer Monographie der gattung Ephedra, durch abbildungen erläutert. Von C. A. Meyer. pls. 1–8. March, 1846.

8^2: 1–39. Über die Zimmtrosen, insbesondere über die, in Russland wildwachsenden arten derselben. Ein Beitrag zu der Flora Russlands. Von C. A. Meyer. March, 1849.

8^2: 41–58. De Cirsiis Ruthenicis nonnullis commentatio botanica. Auctore C. A. Meyer. March, 1849.

8^2: 59–70. Bemerkungen über den Bau und das Wachsthum einiger grossen Algen-Stämme, und über die mittel, das Alter derselben zu bestimmen. Von F. J. Ruprecht. March, 1849.

8^2: 71–81. Die Vegetation des rothen Meeres und ihre Beziehung zu den allgemeinen Sätzen der Pflanzen-Geographie. Erlautert von F. J. Ruprecht. March, 1849.

9^2: 1–24. Kleine Beiträge zur nähern Kentniss der Flora Russlands. Von C. A. Meyer. Nov., 1855.

1. Plantarum species novae, in imperio Ruthenico sponte Crescentes, descriptionibus illustratae.
2. Ueber einige Crepis-Arten aus dem caucasischen Florengebiete.
3. Ueber Astragalus galactites Pall. und einige, mit demselben zunächst verwandte Arten.

9^2: 25–54. Ueber das System der Rhodophyceae. Von F. J. Ruprecht. pl. 1. Nov., 1855.

9²: 55–82. Neue oder unvollständig bekannte Pflanzen aus dem nördlichen Theile des stillen Oceans. Von F. J. Ruprecht. pl. 1–8. Nov., 1855.

Unfortunately very few libraries as yet have realized the importance of binding signature covers, either in their original position, or at the end of the volume. In the latter case, great care must be taken to mark on the signature cover the numbers of the included pages, as in some cases works issued in parts* contain folios from different parts of a volume, or from different volumes of the same work. It is also of great value, in determining priority in biological nomenclature, that the date of receipt of books and periodicals containing natural history articles be stamped on one of the title pages. This is of special value in works giving only the year of publication. Most of our periodicals and some of the irregular scientific serials are now giving the actual date of their publication.

Search for data on the above series led through the Congressional, Department of Agriculture, National Museum, Smithsonian Institution, Geological Survey, Philadelphia Academy, Astor, Columbia University, New York Botanical Garden, Missouri Botanical Garden, Boston Public, Massachusetts Horticultural Society, American Academy, Harvard University, and Boston Society of Natural History libraries. Most of these institutions had more or less complete bound sets; but the Boston Society of Natural History and Philadelphia Academy libraries were the only ones containing any number of bound signature covers of this series and these were very incomplete. This is accounted for largely by the fact that most of these institutions received their numbers at a time when the subject of priority had not demonstrated the value of determining the exact dates of publication.

*e. g. Engler und Prantl, Die Naturliche Pflanzenfamilien und Ascherson und Graebner, Synopsis der Mitteleuropaischen Flora.

Vol. XXI, pp. 19-30 January 23, 1908

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

DESCRIPTIONS OF A NEW SPECIES OF TROUT (*SALMO NELSONI*) AND A NEW CYPRINODONT (*FUNDULUS MEEKI*) WITH NOTES ON OTHER FISHES FROM LOWER CALIFORNIA.

BY BARTON WARREN EVERMANN.

U. S. Bureau of Fisheries.

While carrying on biological explorations in the peninsula of Lower California in 1905 for the U. S. Bureau of Biological Survey, Mr. E. W. Nelson collected a few specimens of fishes. Through the courtesy of the Biological Survey these have been placed in my hands for identification. Although the collection is a small one, containing but 37 specimens representing only 5 species, it is of unusual interest because the specimens come from localities in which little or no collecting had previously been done, and because 2 of the species, a trout and a cyprinodont, prove to be new and undescribed.

The localities represented in the collection are four, namely: the San Ramon River, a small stream at San Ignacio, La Purisima Creek, and some small tide pools at San Felipe Bay.

Mr. Nelson has furnished the data for the following account of these various waters:

The Rio San Ramon has its rise at an altitude of about 7,000 feet in La Grulla meadows on the west side of the San Pedro Martir Mountains, about 150 miles south of the International boundary, and descends through a deep, narrow and precipitous canyon to the vicinity of San Antonio ranch. Below San Antonio the descent is more gentle and the stream winds through a rocky canyon most of the way to the sea. The San Ramon River is merely a small creek during ordinary times, but becomes a torrent during heavy rains. It is said to be the only stream in northern Lower California which always flows to the

sea; the other streams reach the sea only at times of flood and for an irregular period following rainy seasons. They sometimes disappear entirely during long dry periods. At the time of Mr. Nelson's visit (last of July, 1905), the San Ramon River at Rancho San Antonio was about 10 feet wide and 10 inches deep in the middle of the channel, where the current was about 6 miles an hour.

The San Pedro Martir Mountains are made up of a friable granite and the bed of the stream is granite, sand and gravel with many boulders often of huge size. About 12 miles above the San Antonio ranch there is a high waterfall beyond which fishes can not go in ascending the stream. Previous to the winter of 1903–4 there were several large pot-holes in the stream close to San Antonio in which trout were plentiful. During that winter there were excessively heavy rains in this region and the floods in the river brought down great quantities of boulders and other débris, filling the pot-holes in the lower portion of the canyon. The result of this was to destroy the haunts of the trout in that portion of the stream, so that trout are now found only sparingly in the vicinity of San Antonio. Several miles further up the canyon some pot-holes still exist in which trout are reported to be numerous. Trout occur in some numbers from a short distance below San Antonio up to the falls already mentioned, or throughout a distance of about 12 miles. The portion of the stream in which they occur is, according to Mr. Nelson, wholly below the limits of the pine forests. Near San Antonio only small trout are found, but higher up trout 12 to 15 inches long are said to occur. The largest examples seen by Mr. Nelson, however, did not exceed 8 inches in length. From his own observations and from information obtained from residents of the region, Mr. Nelson is convinced that the heavy floods referred to destroyed a considerable percentage of the trout in this stream.

The Cyprinodonts in the collection were obtained in a small stream which flows from large springs at San Ignacio, or approximately in north latitude 27° 10′. These springs rise just above the town of San Ignacio and produce a permanent stream about 30 feet wide and a foot deep which flows through a narrow valley for 10 or 12 miles before the water is lost in the sand. This water course extends to the sea and during rainy

seasons the stream sometimes reaches the coast. A few hundred yards below the springs are some large, deep pools. These fish abound throughout the entire length of the stream.

La Purisima Creek is a stream about 50 feet wide and 18 inches deep, flowing for 20 or 25 miles down a broad, fertile canyon in which is located the settlement known as La Purisima, about 35 miles south of Mulegé, or in north latitude 26°. This stream flows to the Pacific after heavy rains, but it usually loses itself in the sand and is there restricted to the middle of the peninsula. The large goby was found here.

It has never been definitely determined just how far south trout originally extended in the coastal streams of southern California. It has been said that trout are native to a stream near San Luis Rey in the northern part of San Diego County, but the authority for the statement is not known.

A new species of trout* has recently been discovered in the headwaters of South Fork of the Santa Ana River at an altitude of 8,200 feet, near San Gorgonio Peak in the San Bernardino Mountains; and rainbow trout have been introduced into the lower portion of the Santa Ana as well as into many other streams in southern California. A comparison of the specimens of the San Gorgonio and the San Pedro Martir trouts shows them to be very distinct species.

The most southern stream in California in which I have personally taken native trout is Santa Paula Creek, Ventura County, about 200 miles north of the International boundary, or 300 miles from the stream in which the Lower California trout are found. Other small streams in Ventura County contain trout; namely, the Sespi, Sisa, Matillija, and perhaps others, all small streams which dry up in their lower courses during the summer and fall. The trout in these streams is a small species, seldom exceeding 6 or 8 inches in length, brightly colored and possibly identical with the typical rainbow trout, *Salmo irideus*.

Trout have been reported from at least three other localities in Mexico besides the San Pedro Martir Mountains of Lower California.

In 1886, Cope† recorded trout from Mexico in the following note:

* This species is described by Jordan and Grinnell in these Proceedings, pp. 31, 32.

† American Naturalist, XX, August, 1886, 735.

The Most Southern Salmon.—I owe to my friend, Professor Lupton, two specimens of a black-spotted trout from a locality far south of any which has hitherto yielded Salmonidæ. They are from streams of the Sierra Madre, of Mexico, at an elevation of between 7,000 and 8,000 feet, in the southern part of the State of Chihuahua, near the boundaries of Durango and Sinaloa. The specimens are young, and have teeth on the basihyal bones, as in *Salmo purpuratus*, which they otherwise resemble.

Mr. E. W. Nelson visited that locality in August, 1898. He informs me that all the streams of that region flow into the Pacific and that the particular stream in which the trout occurs is a small creek rising on the slopes of Mt. Mohinora, a few miles south of the mining town of Guadalupe y Calvo, Chihuahua. Mt. Mohinora is the highest mountain in the Sierra Madre between the United States border and the high peaks about the southern end of the tableland in Michoacan. The stream in which the trout occur is only 15 to 20 feet wide and a foot or so deep and is, Mr. Nelson thinks, one of the headwaters of the Rio Culiacan.

Dr. Meek states* that he was informed by Mr. A. V. Temple of the Mexican Central R. R., that trout are "found in the Pacific coast streams west of the City of Durango."

This place also was visited by Mr. Nelson in July, 1898. He saw trout in a small creek at El Salto, Durango, a small ranch in a pine-forested plateau of the Sierra Madre over 7,000 feet above sea level and 70 miles south of west from the city of Durango. This stream is about 25 feet wide and a foot deep and is one of the headwaters of one of the rivers flowing into the Pacific not far from Mazatlan in Sinaloa, probably the Rio del Presidio in north latitude about 24°. Mr. Nelson is not entirely certain on this point. He states that the trout of this stream, as well as those near Guadalupe y Calvo are all small, reaching only 5 to 10 inches in length, and that they are not numerous in either place. Both localities are wholly within the yellow pine forest. He has never heard of trout in Mexico in any stream draining into the Rio Grande basin.†

* The Freshwater Fishes of Mexico north of the Isthmus of Tehuantepec. Field Columbian Museum Publication 63, Zoological Series, Vol. V, 97, September 23, 1901.

† Since the above was written, Mr. Nelson has received 5 excellent specimens of trout from El Salto, where they were collected in the fall of 1907 by the Hon. W. C. Bishop, U. S. Vice Consul, at Durango City, Durango. An examination of these specimens shows them to be very distinct from the San Pedro Martir trout. They will be described in a later paper.

The fourth locality in Mexico from which trout have been reported is the headwaters of the Rio Yaqui. The exact locality is not known; it may be in northeastern Sonora or in northwestern Chihuahua. The occurrence of trout in this region is mentioned by Dr. Meek,* on the authority of Mr. John Ramsey, General Manager of the R. G., S. M. & P. R. R., who says "that a trout is quite abundant in the upper tributaries of the Rio Yaqui."

Dr. Meek inadvertently records this trout as a member of the Colorado River fauna under the name *Salmo irideus*, which, of course, is quite erroneous, as the trout of that river is not a rainbow trout, but one of the cutthroat series, *Salmo pleuriticus*. There is considerable geologic evidence that the portions of the western rivers in this region which are east of the Sierra Madre Mountains were formerly the upper tributaries of streams flowing eastward. Some of the streams flowing to the Gulf of California have cut their way back, thus capturing the headwaters of the eastern streams and with them their portion of the eastern fish-fauna.†

This explanation would account for trout in the headwaters of the Rio Yaqui, but would give them a Rio Grande origin which would make them *Salmo spilurus* or a derivative from that species. This may also be the origin of the trout which occur in the streams west of Durango. But it is wholly improbable that trout could have reached western drainage in Lower California from the Rio Grande; the origin of the San Pedro Martir trout must be explained in some other way.

Trout are known to occur in Arizona in a number of mountain streams all of which, however, are tributary to the Colorado. Between these streams and Lower California lies the broad semi-desert region of northern Sonora, the Gulf of California, and the eastern portion of the peninsula, a desert region on the west of which are impassable mountains, beyond which lies the stream in which the trout are found. Trout might have come down the Colorado, but they would have met these same impassable barriers. And westward from the lower course of the Colorado is the broad expanse of desert across which trout can not now possibly pass. What may have been the conditions long ago can not, of course, be definitely known, but it is con-

* See Meek, op. cit. p. XXVII. † Meek, op. cit. p. 96.

ceivable that, when the deserts of Panamint and Amargosa were great lakes or inland seas, trout may have been able to reach Pacific drainage in the northern part of Lower California. From what is known of the geological and hydrographic history of the region this, however, is a remote possibility.

These same difficulties are encountered in considering the possible origin of the Lower California trout from the southern High Sierra. The same deserts were to cross and the distance is greater, unless they came down via Tehachapi Pass and the San Bernardino and San Jacinto ranges, which would have brought them over to the coastal streams.

These coastal streams, however, were probably stocked from other Coast Range streams farther north. This extension was accomplished, in all probability through short journeys in the sea from the mouth of one stream to that of the next. In this way trout succeeded in extending their range as far down the coast as the mouth of the San Luis Rey, if that be a natural trout stream, as has been reported. From that stream, in exceptionally favorable seasons they could have extended their range southward to the mouth of the Rio San Ramon, a distance of approximately 100 miles. This may have been accomplished in a single advance or intervening streams may have been utilized and the advance made in two or more stages. The intervening streams such as the San Diego and the Sweetwater are not known to contain trout and some of them do not ordinarily reach the sea. It is not improbable that they formerly were better suited to trout and that trout may have inhabited them at one time.

Still more conclusive evidence that the San Ramon River was stocked from the sea, or at least that the trout *ascended* the river is found in the fact that there are no trout in its headwaters. The San Ramon has its sources among the highest parts of the Sierra San Pedro Martir. About 12 miles above Rancho San Antonio is a considerable fall which trout can not possibly ascend, and above these falls it is said that trout are not found.

These geographic facts, together with the fact that the Lower California trout is a rainbow trout rather than a cutthroat, lead to the conclusion that the Rio San Ramon in all probability was originally stocked with trout from the coastal streams to

the northward, the trout passing through the sea along the coast from stream to stream until the San Ramon was reached.

It has been suggested that the trout were introduced into the San Ramon by the early Spanish padres many years ago. To have accomplished such a feat successfully would have required a knowledge of fish-cultural methods and a skill in handling and transporting live fish which we have no reason to believe were possessed by the padres. It would be a feat extremely difficult of accomplishment even to-day. That the padres were able to carry live trout hundreds of miles on pack animals across a semi-desert or in a sailing vessel for more than a hundred miles is highly improbable. The difficulties are too great to permit the acceptance of this theory. Moreover, the trout themselves possess characters which preclude the possibility of identifying them with any known species in any of the streams of California, Arizona, Chihuahua, or elsewhere.

We are, therefore, led to the conclusion that the Rio San Ramon of the San Pedro Martir was stocked with trout by natural extension from trout waters of the coast region of southern California and at a period sufficiently remote to have allowed ample time for its specific differentiation.

Fundulus meeki Evermann, sp. nov.

Figure 1.

Head 3.1 in length to base of caudal; depth 3.4; eye 4.5 in head; snout 4; interorbital 2.7; D. 12; A. 12; scales 34–13.

Body short and stout; profile from tip of snout to highest part of back, which is in vertical above base of pectoral, rising rather rapidly and in a straight line, descending slightly thence to dorsal fin along the base of which it drops more rapidly to caudal peduncle whose dorsal and ventral lines are approximately parallel; ventral outline little convex; greatest width of body at pectorals 1.5 in depth; head large, flat, the interorbital broad; eye small; snout rather long and pointed; teeth in a narrow band in each jaw, those of outer series enlarged, subequal, pointed, firm, the tips not dark; caudal peduncle (measured from base of last anal ray to base of caudal fin) 1.4 in head, its least width 3 in its least depth, which is 1.5 in its length; scales rather large, about 25 on median line of back from front of dorsal to snout. Fins small; origin of anal under middle of dorsal, their rays about equal in length and equal to snout and eye; caudal truncate; ventrals small; pectoral 2 in head.

Intestine short, peritoneum black. Color in spirits, back grayish olive, middle of side with a broad more or less interrupted blackish band most distinct posteriorly and in the young, in which it tends to break up in

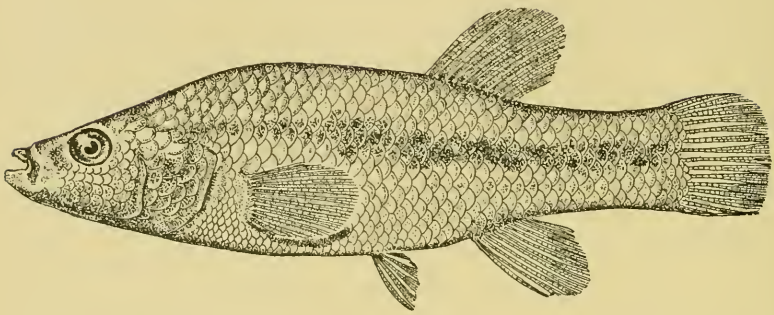


Figure 1.
Fundulus meeki Evermann. Type.

large spots; below this a less distinct series of blackish spots, all these marks varying much in distinctness; lower part of side and ventral surface yellowish white; fins all dusky.

In the male (cotype, No. 61,059, U. S. N. M.) the scales are exceedingly rough, particularly along the side and on the caudal peduncle, this roughness being due to small, sharp, spinelike tubercles on the posterior edge of the scales. The males differ from the females also in being much darker in color.

Type, No. 61,058, U. S. N. M., a female 3.25 inches long, collected October 8, 1905, by Mr. E. W. Nelson, from a small stream flowing from large springs at San Ignacio, central Lower California. Cotypes, 2 males and 16 females ranging in length by from 2 to 3⅜ inches, all collected by Mr. Nelson from the same stream. One or more of these cotypes have been deposited in each of the following museums: U. S. National Museum, U. S. Bureau of Fisheries (No. 1619), Stanford University, Field Museum of Natural History, American Museum of Natural History, Indiana University and Museum of Comparative Zoology.

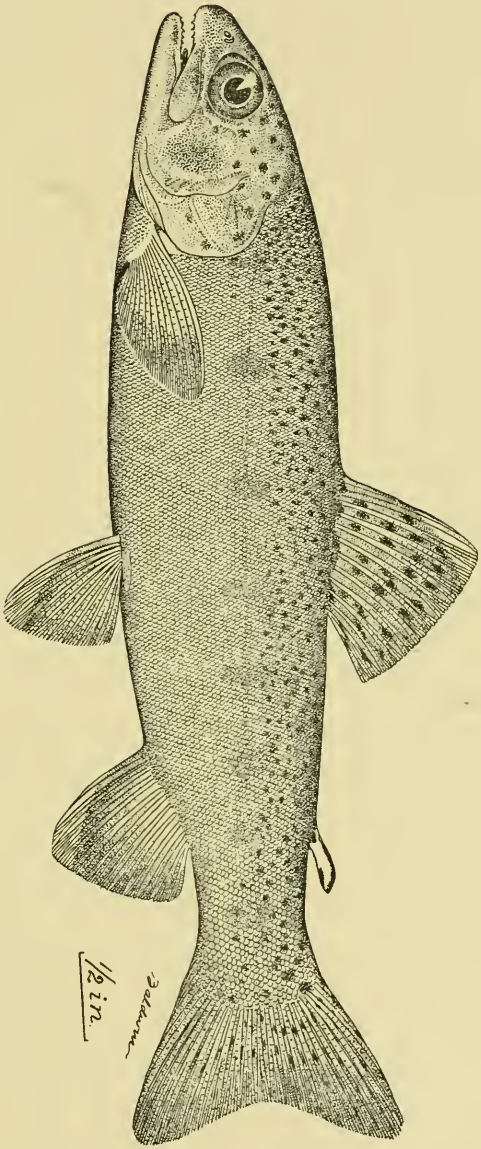
It is with peculiar pleasure that I name this new species of *Fundulus* for my life-long friend, Dr. Seth Eugene Meek, Assistant Curator of Zoology in the Field Museum of Natural History, in recognition of his excellent work on the geographic distribution of the freshwater fishes of Mexico, and with pleasant memories of the days when we were jointly preparing our first paper in systematic ichthyology.

Salmo nelsoni Evermann, sp. nov.

LOWER CALIFORNIA TROUT. Plate I.

Description of the type, a specimen 165 mm. in length to tip of caudal fin:

Head 3.75 in length to base of caudal; depth 4; eye 4 in head; snout 4; maxillary 2.1; mandible 1.8; D. 10; A. 10; scales 38–170–26, about 117 pores.



Salmo nelsoni Evermann. Type.

Body rather slender, the dorsal and ventral outlines little arched; head short, snout short and blunt, equal to eye in length; lower jaw slightly included; maxillary short, nearly straight, little expanded at tip, scarcely reaching vertical at posterior edge of orbit; eye large, equal to length of snout; teeth on jaws and maxillaries in a single row, those on vomer and tongue in a double row and well developed; gillrakers 3 + 9 or 4 + 8, short, stout and flat, 3 in eyes; caudal peduncle stout, its least width 3 in its least depth which is 2.3 in head.

Fins all rather small; pectoral short and rounded, its length 1.5 in head; origin of dorsal midway between tip of snout and base of caudal fin, base of fin equal to length of longest ray which is 2 in head, distal edge nearly straight; base of anal shorter than longest rays, which are a trifle shorter than longest dorsal rays; caudal forked, the lobes bluntly pointed, their length 1.4 in head; ventrals short, not reaching vent, 1.8 in head.

Scales very small, reduced in size and much crowded anteriorly; lateral line well developed; small scales on base of caudal fin.

Color in life (from field notes furnished by Mr. Nelson), back and top of head olive, shading down into silvery on the opercle and on side below lateral line; ventral surface dull white; throat white; back and upper part of side with small black spots and showing a slight golden bronze luster strongest along lateral line and fading below into silvery; a rather indistinct light reddish purple band across opercle and along side to caudal fin, this appearing to overlie the ground-color; dorsal and caudal fins grayish olive, with black spots; adipose fin olive, spotted with black; pectoral fins plain, dingy grayish; ventral fins dull olive with a terminal band of white at tip; anal fin olive, mottled indistinctly with blackish and edged on tips of anterior rays with an oblique band of white; eyes dull olive-brown, with golden luster. (Some small examples had the pectoral and ventral fins distinctly yellowish).

Color in spirits, caudal peduncle and entire side above lateral line closely covered with small stellate or irregular black spots; top of head somewhat less thickly covered with roundish black spots and a few similar spots on upper part of opercle; body below lateral line with smaller, less distinct spots; about 11 oblong vertical parr-marks on side (most distinct in smaller examples); dorsal fins with about 5 rows of rather larger black spots, a subterminal black area on anterior rays which are tipped with light orange; caudal spotted with black, the spots smaller than those on dorsal; anal dusky, tips of anterior rays light orange or whitish; pectorals and ventrals slightly dusky, the latter white-tipped.

Type, No. 61,056, U. S. National Museum, a specimen 165 mm. long, collected July 30, 1905, by Mr. E. W. Nelson from San Ramon River at Rancho San Antonio (altitude 2,000 feet), in the San Pedro Martir Mountains, 35 miles northeast of Port San Quintin, Lower California.

The eight cotypes have been deposited one in each of the following museums: U. S. National Museum (No. 61,057), U. S. Bureau of Fisheries (No. 1620), Stanford University, Museum of Comparative Zoology, American Museum of Natural History, Indiana University, and Field Museum of Natural History.

Comparative measurements of the type and 8 cotypes are given in the following table:

No.	Total length in mm.	Standard length in mm.	Head in mm.	Depth in mm.	Eye in mm.	Snout in mm.	Maxillary in mm.	Mandible in mm.	Dorsal.	Anal.
4498	165	138	38	35	10	10	19	22	11	12
4499	155	133	36	34	10	10	19	22	10	11
4500	145	132	38	33	10	9	20	22	11	11
4501	177	152	43	36	12	12	24	26	11	11
4502	133	116	32	30	9	9	17	18	11	11
4503	125	110	29	28	8	8	14	15	12	12
4504	125	110	30	30	8	8	15	16	11	11
4505	130	114	30	29	9	9	17	18	12	11
4506	130	114	32	26	9	9	18	19	11	11

From the above table it may be seen that the characters of the species are quite constant. There is some variation in color, the smaller examples being more fully spotted. I have been able to compare the Lower California specimens with specimens of trout of the same size from the Rio Grande and the Kern River region and with somewhat larger examples from the Colorado and Sacramento rivers. Compared with the Colorado River trout (*Salmo pleuriticus*), this species is found to differ in the much larger eye, shorter, blunter and more rounded snout, much shorter maxillary, rather more posterior position of the dorsal fin, the smaller size of the spots on the body, the fewer spots below lateral line, and the brightly colored tips of the dorsal, anal and ventral fins. From the Rio Grande trout (*Salmo spilurus*),* it differs in the larger eye, shorter maxillary, and in the coloration, which is markedly different. In the present species, the spots on the back and upper part of side are irregular in shape and closely placed; below the lateral line there are few, if any, spots, except in the smaller individuals. The Rio Grande trout has the spots on back and side more nearly round and regular in shape, and more widely scattered, and there are similar spots, though less numerous, below lateral line; and the dorsal, anal and ventrals are not tipped with white or orange.

The present species belongs, however, to the Rainbow trout series and is more closely related to the Kern River trout and the various species of Golden trout of the Kern River region, agreeing with them in the small scales, the position of the dorsal, and the bright tips to the dorsal, anal and ventral fins. The black spots as to their character and distribution resemble somewhat those of the Kern River trout, but even in this respect the differences are marked. All the trout of the Kern River region have the maxillary longer, the snout longer and more pointed and the fins larger.

Specimens of trout from coastal streams of southern California are not at hand and no direct comparison has been made between examples from that region and the Lower California trout.

* Specimens of same size from Del Norte, Colorado.

The San Pedro Martir trout is, as already stated, abundant in the Rio San Ramon, and it is hoped the remoteness of the stream from civilization may enable it to remain so. I have been informed by Mr. E. W. Funcke, of San Quintin, Lower California, that an English angler who went into that region in June, 1906, took in 2 days, fishing between 3 and 4 hours each day, over 100 trout. They ranged from 5 to 11.5 inches in length. They are said to be very game.

It gives me great pleasure to name this interesting species of trout for my friend Mr. Edward W. Nelson, in recognition of his valuable studies of the fauna and flora of Mexico.

Awaous taiasica (Lichtenstein).
GOBY; GUAVINA.

One large example, 8.375 inches long, from a small stream at La Purisima, south central part of Lower California, November 4, 1906.

Gillichthys mirabilis Cooper.
LONG-JAWED GOBY.

Seven small examples from tide pools in rocks on shore of San Felipe Bay, Gulf of California, June 23, 1905.

Remora remora (Linnæus).
REMORA.

One small example, 2.75 inches long, obtained from a hammerhead shark at Magdalena Bay, December 2, 1905.

The following additional species have been recorded from Lower California freshwater localities:

Fundulus vinctus Jordan & Gilbert.
Cape San Lucas* (Coll., John Xantus).
Jordan & Gilbert, Proc. U. S. Nat. Mus., V, 1882, 355; Meek, 105.

Fundulus extensus Jordan & Gilbert.
Cape San Lucas* (Coll., John Xantus).
Jordan & Gilbert, Proc. U. S. Nat. Mus., V, 1882, 355; Meek, 108.

Characodon furcidens Jordan & Gilbert.
Cape San Lucas* (Coll., John Xantus).
Jordan & Gilbert, Proc. U. S. Nat. Mus., V, 1882, 354; Meek, 122.

Lucania browni Jordan & Richardson.
"From the outbreak of a hot spring on the eastern margin of the salt lake that lies between the Coast and Cocopah ranges in northeastern Lower California." (Coll., Herbert Brown.)
Jordan & Richardson, Proc. U. S. Nat. Mus., XXXIII, 1907, 319, with figure.

* I am informed by Mr. E. W. Nelson that he found no fresh or even brackish water in the vicinity of Cape St. Lucas in the dry season. There is fresh and brackish water at San José, about 16 miles along the coast to the northeast and from 40 to 50 miles to the northwest, near Pescadero and Todos Santos. Xantus made collections at Todos Santos and the fishes labeled Cape St. Lucas may have come from there.

Siphostoma starksi Jordan & Culver.

San José del Cabo (Coll., Gustav Eisen).

Rutter, Proc. Cal. Ac. Sci., Ser. 2, Vol. VI, 1896, 263; Meek, 163.

Agonostomus monticola (Bancroft).

San José del Cabo (Coll., Gustav. Eisen).

Agonostomus nasutus, Rutter, Proc. Cal. Ac. Sci., Ser. 2, Vol. VI, 1896, 263.

Agonostomus monticola, Meek, 186.

Neomugil digueti Vaillant.

Torrent in the Sierra de las Cacachilas de Santa Cruz (Coll. M. Leon Diguet).

Vaillant, Bull. Soc. Philom., IV, 1883–1894 (June, 1894), 73; Meek, 188.

Pomadasis bayanus Jordan & Evermann.

San José del Cabo (Coll., J. F. Abbott).

Gilbert & Starks, Fishes of Panama Bay, in Mem. Cal. Ac. Sci., IV, Feb. 6, 1904, 109. "The records do not show whether this specimen was taken in the river at San José or in the sea." Meek, 201. (Dr. Meek questions the identity of the San José specimen with this species.)

Philypnus dormitor (Lacépède).

Cape San Lucas (Coll., John Xantus).

San José del Cabo (Coll., Gustav Eisen).

Philypnus lateralis Gill, Proc. Ac. Nat. Sci. Phila., XII, 1860, 123. Rutter, Proc. Cal. Ac. Sci., VI, 1896, 264.

Philypnus dormitor, Meek, 226.

Dormitator maculatus (Bloch).

Rio San José, San José, del Cabo (Coll., Gustav Eisen).

Rutter, Proc. Cal. Ac. Sci., VI, 1896, 265; Meek, 227.

Eleotris pictus Kner & Steindachner.

San José del Cabo (Coll., Gustav Eisen).

Rutter, Proc. Cal. Ac. Sci., VI, 1896, 265; Meek, 229.

VOL. XXI, PP. 31-32 JANUARY 23, 1908

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

DESCRIPTION OF A NEW SPECIES OF TROUT (*SALMO EVERMANNI*) FROM THE UPPER SANTA ANA RIVER, MOUNT SAN GORGONIO, SOUTHERN CALIFORNIA.

BY DAVID STARR JORDAN AND JOSEPH GRINNELL.

STANFORD UNIVERSITY.

Salmo evermanni Jordan & Grinnell, sp. nov.

Type.—Male, No. 20,389, Stanford University; collected by Joseph Grinnell, August 17, 1907, in the headwaters of the South Fork of the Santa Ana River, at 8,200 feet altitude, four miles northwest of San Gorgonio Peak, the highest mountain in southern California. Cotypes in the U. S. National Museum and the U. S. Bureau of Fisheries from the same locality.

Description of type.—Length of type, an adult male (as measured when first caught), 11⅝ inches (296 millimeters); head measured along side 2¾ inches (70 millimeters). Head 3⅝ in length to base of caudal, the jaws being somewhat produced; depth of body 4⅔; eye 6½ in head; maxillary 1¾ in head; dorsal with 10 rays, anal with 10; 34 scales between base of dorsal and lateral line, 167 oblique rows crossing lateral line, and 33 scales between lateral line and vent. Snout (from eye) 3⅓ in head; anal 2 in head; ventral 2⅕ in head; pectoral 1⅜ in head; dorsal 1¼ in head. Caudal distinctly emarginate, or lunate. Vomerine teeth in two straight rows; hyoid teeth present, though buried in mucus; maxillary extending well beyond eye, so that the mouth is relatively large. In the female, the head is shorter and the mouth a little smaller; the maxillary 1⅓ in head. Coloration, very dark fawn-brown, the spots unusually large and covering the whole length of the body, none of the brilliant hues of *Salmo agua-bonita*, *roosevelti* or *whitei*, nor even the crimson of *irideus*. Ground fawn-color along sides, varying toward seal brown dorsally; a large patch of same color on cheek; lower parts lighter (fresh tints unknown, but no red in throat region shown in the specimens); black spotting conspicuous, the spots evenly distributed, very large, on sides posteriorly the size of pupil or larger, smaller on top of head; 25 spots on dorsal fin, mostly in four rows; caudal fin nearly as distinctly spotted as sides, with spots more closely set. Younger individuals are somewhat lighter, but yet consider-

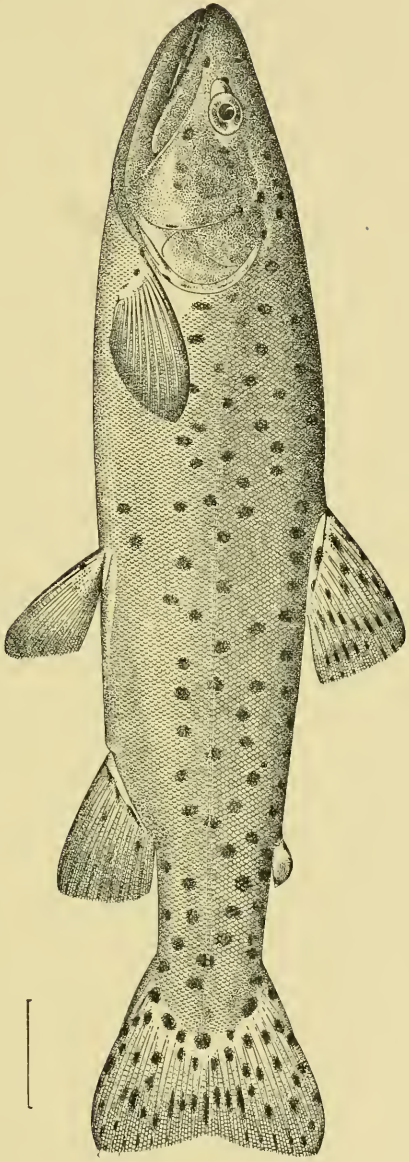
ably darker than *irideus* of the same size, and the other characteristics seem to be constant.

Comparison.—As compared with *Salmo irideus* Gibbons, *Salmo evermanni* is slenderer, especially dorso-ventrally; the head is longer, the snout sharper, and mouth larger; the scales are very much smaller, and more numerous, not overlapping; the colors are dull and very dark, and the spotting is heavy.

Remarks.—On August 17, 1907, the junior author fished down the upper South Fork of the Santa Ana, starting well up in the Big Horse Meadows at about 8,300 feet altitude. A Cincinnati No. 24 double-gut bass hook was used with earthworms as bait. The stream is steep and rapid, there being but few pools with quiet margins. Most of the 30 trout obtained that day were obtained in these pools. Below the meadows a mile or so the canyon becomes extremely steep and narrow; and in this gorge at about 7,500 feet altitude is a series of water-falls, the highest estimated at 18 feet of sheer drop. Twenty-four of the thirty trout were secured above this point, and every one of these belonged to the new species. Five of them were preserved in formalin, changed in a few days to alcohol, and these include the type and cotypes of the present description. The junior author fished on down below the above-mentioned falls, and began to take the typical rainbow trout, *Salmo irideus*, common in all the lower streams of the region. Six of them were taken that day. During June, July and August, of 1907, 580 trout were caught in the main Santa Ana from Seven Oaks, 5,000 feet altitude, to Big Meadows, 6,700 feet, and in the tributary canyons of Fish Creek, Lost Creek and the lower South Fork. All of these were of the *irideus* type, which nothing prevents from ascending the main stream from the vicinity of Seven Oaks, which is now freshly stocked nearly every year. But very evidently none has been able to get up over the series of falls towards the head of the South Fork.

It seems to us, therefore, probable that *Salmo evermanni* is the older species in the region, and owes its preservation as a distinct species, and perhaps the accentuation of its characters, to isolation afforded by the barrier which prevents the invasion of *Salmo irideus* from the lower stream. In the remote history of the stream, the falls have doubtless shifted and become more effective, so that the ancestral stock of *Salmo evermanni* was originally able to ascend to its present remote and limited habitat.

This interesting species is named for Dr. Barton Warren Evermann in recognition of his varied and valuable investigations of the American *Salmonidæ*. The figure is by Mr. William S. Atkinson.



Salmo evermanni Jordan & Grinnell. Type.

Vol. XXI, pp. 33-34 January 23, 1908

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

DESCRIPTION OF A TROUT FROM LAKE KOOTENAY IN BRITISH COLUMBIA.

BY DAVID STARR JORDAN AND JOHN OTTERBEIN SNYDER.

Stanford University.

The Museum of Stanford University has lately received, through the courtesy of Mr. John P. Babcock, Commissioner of Fisheries for British Columbia, a very large trout weighing 22 pounds, from Lake Kootenay, a tributary of the Columbia in British Columbia.

This specimen seems to belong to the species or subspecies described from Lake Kamloops in the same region by Dr. Jordan (Jordan & Evermann, Fishes North and Middle Amer., I, p. 489, 1898), from two specimens (44,238, U. S. N. M.) collected by Mr. A. C. Bassett. These specimens were but 16½ inches long. They were much more slender than the specimen before us, and there was a rosy band along the side.

The fish in hand differs in the much greater depth — perhaps due to age, in the longer head — perhaps a character of the male, and in the absence of any rosy shades whatever.

Nevertheless, it is probably an old individual of the same species, *Salmo kamloops*. It is close to the Steelhead Trout, *Salmo rivularis* Ayres (wrongly called *Salmo gairdneri* by most recent writers), differing mainly in the robust body, the much larger head and in the much larger number of rows of spots on the dorsal fin. We present a description and figure of the Kootenay specimen.

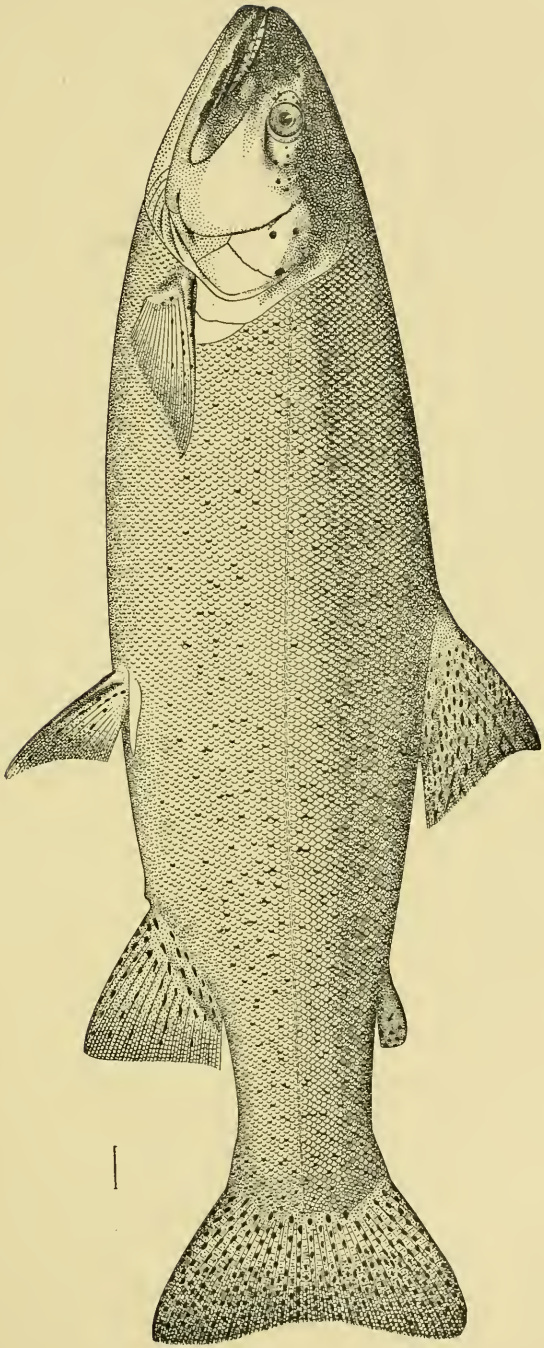
Head 3.9 in length, measured to end of last caudal vertebra; depth 3.6; depth of caudal peduncle 2.4 in head; diameter orbit 6; width of interorbital space 2.6; snout 3; maxillary, measured from tip of snout, 1.6; D. 11; A. 11; scales in lateral series 148, between base of ventral and

lateral line, counting upward and forward 35, between lateral line and insertion of dorsal 30, between occiput and insertion of dorsal 72. Large hyoid teeth present.

Body robust and heavy, appearing especially so when compared with the very short fins and stumpy tail; mouth large, the maxillary extending far beyond eye; gillrakers pointed, rather short, 7 on upper limb of first arch, 12 on the lower; longest dorsal ray 2.4 in head; anal 2.2; pectoral 1.8; ventral 2.1; caudal 1.7; posterior outline of caudal slightly concave.

Color, dark above, silvery on sides and below; no red underneath lower jaw; upper part of head, tip of snout, and upper part of lower jaw blackish; sides with small, scattered black spots, none of which is larger than half the exposed portion of a scale; dorsal, anal and caudal with many small, black spots, those of dorsal and anal mostly elongate, the former in about 11 indistinct, longitudinal rows; those of caudal more rounded and more numerous, there being from 9 to 16 in rows along the rays; pectorals and ventrals sparsely spotted; a few scattered spots on upper part of head; adipose dorsal with about 12 small spots. No trace of rose color along the sides.

The following measurements are in inches: length to tip of caudal 34½; depth 8½; head 8; depth caudal peduncle 3¼; snout 2¾; orbit 1½; maxillary 4¾; dorsal 3¾; anal 3½; caudal 5½; pectoral 4¾; height adipose dorsal 1¼. Weight 22 pounds.



Salmo kamloops Jordan.

Vol. XXI, pp. 35-38 January 23, 1908

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NOTES ON DIURNAL MIGRATIONS OF BATS.

BY ARTHUR H. HOWELL.

Very little seems to be known about the migrations of bats, either as to their extent, the manner in which they are performed, or the species which have the migratory habit. Indeed, it is only within comparatively recent years that any mention of this habit among bats has appeared in literature.

In 1888 Dr. C. Hart Merriam published a paper* under the title "Do any Canadian Bats migrate? Evidence in the affirmative," in which he showed conclusively that two species of tree-dwelling bats—*Lasiurus cinereus* and *Lasionycteris noctivagans*—inhabiting the Canadian fauna of North America, perform regular migrations. The evidence presented consisted in records of the occurrence in winter of these species far to the southward of their breeding range and the occurrence of *Lasionycteris* in spring and fall at Mount Desert Rock, a small barren islet thirty miles off the coast of Maine. The only other detailed account of bat migration with which I am familiar is that given by Mr. G. S. Miller, Jr., in a paper published in "Science"† wherein he describes the appearance and disappearance of bats at Cape Cod, Massachusetts. The species noted by him were the Red Bat (*Lasiurus borealis*), the Hoary Bat (*Lasiurus cinereus*), and the Silver-haired Bat (*Lasionycteris noctivagans*), and their migrations were recorded as occurring in the evening (after sunset) on numerous dates between August 21 and September 13. The specimens observed were flying chiefly along the face of bluffs near the light-house. No evidence of a southward movement was discovered, but the fact that no bat could be found on the Cape

* Trans. Royal Soc. Canada, V, Section IV, pp. 85-87.

† Science (N. S.) V, No. 118, pp. 541-543, April 2, 1897.

during the early part of the summer indicated that those seen in August and September were migrants.

The observation which I have to record, though very unsatisfactory in that the migrating species could not be identified, is so unusual in several respects that an account of it is presented in the hope that observations of a similar nature by others may be brought to light.

The morning of September 28, 1907, at Washington, D. C., was cloudy and mild, with the wind light northeast. Rain began to fall about 3 P. M. About 9 A. M. several bats were observed flying at a considerable height over my house in the suburb of Woodridge, a short distance from the Boys' Reform School. A few minutes later several more appeared, and the flight continued from 9 o'clock until about 10 o'clock, during which time over a hundred bats were noted, all flying leisurely in one direction with the wind, *i. e.* southwest. A single individual was seen at 10.45 A. M. They were not in flocks, but were flying singly, usually only four or five being in sight at one time. The manner of flight was quite unusual, for instead of the erratic zigzag flight commonly adopted by bats when seeking their food at dusk, the flight of those noted on this occasion was very steady, consisting chiefly of a sailing or drifting motion with occasional short flappings of the wings. Only a few of those observed indulged in the characteristic bat flight and these for only a few moments. The height of the bats above the ground was estimated as varying between 150 and 400 feet — certainly none were lower than 150 feet and a few were probably higher than 400 feet. At this distance they looked so much like huge butterflies that at first I could hardly believe they were bats, but after observing them a few minutes through a field glass, it became evident that they were indeed bats. At least three sizes and probably three or more species were represented, but even with the aid of the glass, no positive identifications could be made. Most of them were about the size of the Red Bat and very probably were either this species or the Silver-haired Bat. A few appeared larger than these species, and a few were decidedly smaller, belonging apparently either to the genera *Myotis* or *Pipistrellus*, though neither of these genera is as yet known to migrate, in North America.

Inquiry has been made of a number of naturalists of wide

field experience, and none of them has ever observed a similar flight of bats, in which the southward migration was so clearly evident.

Dr. Edgar A. Mearns, however, in his list of mammals of the Hudson Highlands* has recorded his observation of diurnal flights of the Red Bat, but has given no details of the movement. He says, "I have never seen a Red Bat taken alive at that season [winter]. It is possible that the species migrates to the south in the autumn and returns in the spring. During the latter part of October and the first week of November I have seen great flights of them during the whole day. * * * One year specimens are recorded on four days, on two days only males and on two only females."

Dr. Mearns tells me that in addition to these observations of the Red Bat in New York, he has seen a diurnal flight of Hoary Bats at Fort Snelling, Minnesota, but as his field notes are at present inaccessible, details of the flight can not now be given.

If diurnal migrations such as are recorded above are of regular occurrence, it seems remarkable that they have not been more frequently observed. Probably, however, such flights are the exception rather than the rule.

* Bull. Amer. Mus. Nat. Hist. X, 1898, p. 345.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NOTES ON *RHINOMURAENA*.

BY THOMAS BARBOUR.

While shore collecting at Ambon in the Moluccas during February, 1907, I caught an interesting eel, which is closely related to one described by Mr. S. Garman as *Rhinomuraena quaesita*.

In 1877 the Rev. B. G. Snow sent to the Museum of Comparative Zoölogy a collection of littoral fishes from Ebon in the Marshall Islands. This collection contained a peculiar eel on which Garman founded the Genus *Rhinomuraena*. No additional specimens of this genus have ever reached this museum. The eel which Jordan and Seale obtained in Samoa and described as *Rhinamuraena* (*sic*) *eritima* is, I believe, generically distinct both from *R. quaesita* Garman (Bull Essex Inst., 1888 [1889] pp. 114–116, fig.) and from the specimen taken at Ambon, which represents a new species. The three forms may be characterized as follows:

Rhinomuraena Garman l. c., p. 114.

Generic characters.—Nasal tubes present; rostral appendages situated at apices of both upper and lower jaws; uniserial teeth of about equal size; tail extremely elongate.

R. quaesita Garman.

This description is based on the type specimen which is still well preserved. Head 20.5 in total length, 6.7 in body anterior to vent; depth 3.6 in head; the length of the body is contained 2.2 times in the tail; length of snout from the posterial nostril 6.5 in head; eye 2.3 in snout; the angle of the jaws takes up one-third of the length of the head, jaws straight and may be completely closed; the dorsal fin begins a short distance behind the angle of the jaws; it is at first low, then increases in depth, until, at a distance midway between vent and tip of tail, its depth equals that of the body; the anal fin begins immediately posterior to the

vent; its depth is about one-half that of the dorsal fin. The posterior nostrils are on a line with the upper edge of the eye, and a little anterior to it; there is no elevation of the skin around the opening to form tubes. The anterior nostrils are produced into tubes slit distally and ending in foliaceous appendages. On the tip of the snout are four filamentous appendages, one at the apex of the upper jaw and three at the symphysis of the lower jaw. The gill opening is about twice the diameter of the eye. The teeth are all small pointing slightly backward, uniserial on both jaws and palate, the three anterior palatine teeth are slightly enlarged and lengthened; there are about 20 teeth in each of the three upper series and about 15 in each of the lower.

Color (after Garman).—"Body, head, tail, and inside of mouth cavity black; upper half of dorsal yellow; lower margin of anal white; lower lip white, except at and near the symphysis."

The specimen is about thirty-three inches long.

Type locality, Ebon Island (also called Boston Island and Covel Island). Ebon Islet, 5 miles long, forms the south and southeast side of an atoll. There are 21 wooded islets on this reef, of which this is the largest and most important. Situation, Marshall group, 4° 48′ N., 168° 45′ W. *Fide*, Brigham, W. T.—Index to the Islands of the Pacific. Mem. B. P. Bishop Mus. Honolulu H. T., Vol. 1, No. 2, 1900.

R. ambonensis sp. nov.

Head 19 in total length, 5.75 in body anterior to vent; depth 4 in head; the length of the body is contained 2.25 in tail, length of snout from the posterior nostril 7.25 in head; eye a little more than 2 in snout; angle of jaws 3.4 in length of head, jaws straight and may be completely closed; the proportions of the fins are the same as in the preceding species. The posterior nostrils are one-third the diameter of the eye situated a little anterior to its upper margin. The anterior nostrils are typical of this genus, and the stalk and leaf in both of these species is a little longer than the distance from the tip of the snout to the posterior margin of the eye. (In Garman's figure these organs are represented about one-quarter too large.) The teeth of this form differ from those of *R. quaesita* in that on the upper side the anterior three teeth of each of the three rows are slightly enlarged, while on the lower jaw the teeth are minute and about 28 in number.

Color (from field notes of fresh specimen).—Body azure blue; on the tail this becomes lavender changing on the posterior part to buff with a pale edge; anal fin deep slate color with a yellow edge. The colors have changed slightly in alcohol, the yellow having faded to a cream color and the tones generally having become duller.

A single example 40½ inches long, taken in a shallow tide pool under a flat rock, Feb., 1907.

Ambon (Amboina), one of the Moluccas; Dutch East Indies.

In regard to the species which has been described by Jordan and Seale (The Fishes of Samoa. Bull. U. S. Bureau of Fisheries, Vol. XXV, 1905

[Dec., 1906] p. 196, fig. 6), as *R. eritima*, it may be added that this form is not congeneric with the two forms described above. Since it does not belong to a known genus, it may be hereafter known as—

Rhinechidna gen. nov.

Generic characters (*fide* Jordan and Seale, l. c., p. 196).—"Posterior nostrils consisting of slightly elevated tubes"; "anterior nostrils * * * long, about equal to eye, terminating in an expanded disc two-thirds as wide as eye"; "jaws curved and can not be completely closed"; "teeth in lower jaw in a single row of 25 sharp, concave teeth on each side, the anterior fin being enlarged; posterior teeth of upper jaw small and uniserial, the anterior teeth large biserial canines, three of which are on the median line of the vomer." The length of the body is the same as that of the tail.

Only one species is known.

Rhinechidna eritima (Jordan and Seale).

Type a single specimen 20.15 inches long, taken at Pago Pago, Tutuila Island, Samoa. No. 51,717 U. S. National Museum, Washington.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

ON SOME RARE AND NEW BIRDS FROM BRITISH HONDURAS.

BY OUTRAM BANGS AND MORTON E. PECK.

The following short descriptions of four new birds from British Honduras and records of a few others so rare as to be worthy of special notice are here given in advance of a complete list of the birds of British Honduras soon to be published by Mr. Peck.

The specimens upon which these notes are based were collected by Peck in the last year or two and from time to time were sent with many others to Bangs for comparison and identification.

Mr. E. W. Nelson of Washington has most kindly compared many skins for us with Mexican material under his charge in the collection of the Bureau of Biological Survey of the U. S. Department of Agriculture.

Rallus pallidus Nelson.

One adult female, apparently referable to this distinct form of Clapper rail, was taken at Ycacos Lagoon, May 14, 1907.

This specimen (No. 19,747 Bangs coll.) is we believe the second recorded example of *Rallus pallidus*, the type from Rio Lagartos, Yucatan, collected in April, 1893, by W. W. Brown, Jr., being in the Field Columbian Museum. The under tail-coverts in our bird differ a little from those of the type, being white blotched and barred with dusky, whereas the type had white under tail-coverts with narrow shaft streaks of dusky brown. We find, however, considerable individual variation in the under tail-coverts of Clapper rails generally, and do not consider this a difference of any great importance.

Another specimen was taken, and several seen, in 1900, in a swamp at the mouth of Manatee River, and the bird is not uncommon, but inhabiting the thick, low mangroves is very difficult to secure.

Limnopardalus maculatus insolitus subsp. nov.

Type (and only specimen) from Ycacos Lagoon, British Honduras, adult (sex not determined), No. 16,029, Coll. of E. A. and O. Bangs, taken in June, 1907 (by a friend of Peck's who sent it to him).

Characters.—Similar to true *L. maculatus* (Bodd.) of South America,

but slightly smaller, with smaller feet and bill; wings much less marked with white; the brown portions of plumage-wings, back, rump, etc., much darker (seal brown in the new form, mummy brown in true *L. maculatus*).

Measurements.—Type (sex not determined). Wing, 121; tail, 43; tarsus, 40; middle toe, without claw, 39.5; culmen, 48.

Remarks.—Although the type is the only example of the spotted rail from Central America that we know of, there can be no doubt that it represents a form well differentiated from the South American bird. The much darker color of the brown parts is very striking. Our skin is in worn summer plumage, and all the white markings are reduced in size from wearing away of the tips of the feathers, so that it is difficult to tell what real differences there are in this respect, but certainly the wings are much less marked with white.

A rail of this sort occurs in Cuba and in Jamaica, but just what these island birds are like remains to be seen.

Bubo magallanicus mayensis (Nelson).

A young male, with some traces of the downy first plumage still remaining, was taken in the Manatee District May 20, 1906. This appears to be the second known example of this small pale race of the Great horned owl, the range of which is thus extended from Yucatan to British Honduras. The skin (No. 19,913 Bangs coll.) was carefully compared with the type by Nelson.

Antrostomus badius sp. nov.

Type (and only specimen) from the Toledo District, British Honduras. ♂ adult, No. 19,990, coll. of E. A. and O. Bangs. Collected January 2, 1907, by Morton E. Peck.

Characters.—In general resembling *A. salvini* Hartert of Yucatan, but entire body much more reddish or rusty-buff; chin and throat more heavily barred—the barring dark rusty-buff; abdomen and crissum paler; a broad band, from lores, through eyes, across ear coverts and forming a collar around hind neck dark, rich golden buff—much brighter and more strongly marked than in *salvini*; tips of outer rectrices narrowing to a blunt point instead of broad and rounded as in *salvini*, and with much narrower, or smaller, buffy tips.

Measurements.—Type, ♂ adult. Wing, 165; tail, 120; tarsus, 17.5; exposed culmen, 15.5.

Remarks.—This bird, of which a single adult male was taken, represents a species apparently quite distinct from *A. salvini* though more nearly related to it than to any other Mexican or Central American form. Besides differing in the details of color, markings, etc., pointed out above, the general coloration of *A. badius* is very decidedly rusty or reddish brown, whereas *A. salvini* is of a grayish-brown general coloration.

Pachyrhamphus major itzensis Nelson.

A young male in a plumage similar to that of the adult female was taken in the Toledo District, January 24, 1907.

This specimen is even smaller and paler than the type, and the range of the form must be extended to include British Honduras.

Terenotriccus erythrurus fulvigularis (Salv. & Godm.).

Several specimens of this little tyrant-bird, which until Mr. Dearborn's recent record * from Los Amates, Guatemala, had been traced no farther north than San Pedro Sula and Santa Anna, Honduras, were taken in the Toledo District. These were all found along the banks of the Tunach River, near the Guatemala border, where about two dozen individuals were seen.

Upon comparing this series with numerous skins from Costa Rica and Chiriqui, slight differences can be seen. British Honduras specimens while in other dimensions averaging equal to more southern ones appear to have smaller bills, and the forehead back to the centre of the crown is constantly strongly suffused with buff-cinnamon, there being usually but a faint trace of this in specimens from Costa Rica and Chiriqui.

Heleodytes zonatus restrictus Nelson.

Some perfectly typical examples of this well-marked race were taken in the Toledo District, thus extending its range to British Honduras.

Pheugopedius maculipectus (Lafr.).

The Spotted breasted wren from the Toledo and Manatee districts of British Honduras, represented by a fine suit of skins, is interesting as being exactly intermediate in every character between subspecies *cano-brunneus* and *umbrinus*.

Troglodytes irrequies sp. nov.

Type from Sittee River, British Honduras. ♂ adult, No. 19,802, coll. of E. A. and O. Bangs. Collected April 22, 1907, by M. E. Peck.

Characters.—Similar to *T. peninsularis* Nelson of the coast of Yucatan, with large bill and feet as in that form; but even smaller in other measurements; darker brown above; breast and sides more buffy; posterior flanks and under tail-coverts much darker, more reddish brown, and more strongly barred with dusky (in this latter respect approaching the form found in the interior of Chiapas and Guatemala—*Troglodytes musculus hyaëpdon* (Sclater)).

MEASUREMENTS.

No.	Sex.	Locality.	Wing.	Tail.	Tarsus.	Exposed Culmen.
19,802	♂ ad.	B. H. Sittee R.	48.5	35	18.	14.
19,846	♂ ad.	B. H. Toledo Dist. . . .	46.	34	17.5	14.
19,803	♀ ad.	B. H. Sittee R.	47.	35	17.	13.5

Remarks.—The three specimens from British Honduras, listed above, represent a well-marked form related to *T. peninsularis* which in the absence of intermediates seems to require full specific rank.

Coturniculus savannarum cracens subsp. nov.

Type from Ycacos Lagoon, British Honduras. Adult ♂, No. 19,770, coll. of E. A. and O. Bangs. Collected March 10, 1907, by M. E. Peck.

* Catalogue of a Collection of Birds from Guatemala, by Ned Dearborn, Field Museum of Natural History, Publication 125, Vol. 1, No. 3, November, 1907, p. 104.

Characters.—Most like *C. savannarum obscurus* Nelson of the coast of Vera Cruz, Mexico, but with all the characters of that form carried to a still greater extreme—about as different from *C. savannarum obscurus* as that bird is from *C. savannarum passerinus.* Similar to *C. savannarum obscurus,* but smaller in all measurements; colors (sexes alike in color) darker—whole upper parts with dusky greatly predominating and with scarcely any rusty-brown mottling; chest, sides and flanks very dark—dull tawny-ochraceous.

MEASUREMENTS.

No.	Sex.	Locality.	Wing.	Tail.	Tarsus.	Exposed Culmen.
19,770	♂ ad.	Yeacos Lagoon B. H. . .	53.	38.	18.	9.
19,771	♀ ad.	do. . .	50.	35.	18.	10.
19,772	♀ ad.	do. . .	50.5	37.5	17.5	9.5
19,773	♀ ad.	do. . .	52.	38.	18.	9.

Remarks.—The breeding grasshopper sparrow of British Honduras is the most extreme form yet described, in point of small size and dark coloration; the upper parts being almost solid blackish, broken only by the median crown stripe and some slight grayish edges to the feathers of the hind neck and back. One skin only among the four examined has slight rusty-brown markings on nape and rump.

Coturniculus savannarum passerinus occurs in the same general region in winter, an adult male having been taken in the Toledo District December 3, 1906. This specimen (No. 19,886 Bangs coll.) affords the following measurements: wing, 62; tail, 45; tarsus, 19.5; exposed culmen, 11.

Aimophila rufescens discolor Ridg.

In his Birds of North and Middle America, Ridgway relegates *A. rufescens discolor* to the synonomy of *A. rufescens rufescens,* still having but the original series from Segovia River, Honduras, in much abraded condition of plumage.

Three specimens in fine spring plumage collected in March, 1907, at Yeacos Lagoon, British Honduras, are identical with the Segovia River birds and differ from true *A. rufescens* in smaller size—much shorter wing and tail—heavier bill, in the color of the breast and flanks being decidedly paler and less brownish, and in the sides of the head being darker, clearer gray.

Aimophila rufescens discolor therefore has a wide range, being now recorded from places so distant as Segovia River, Honduras, and Yeacos Lagoon, British Honduras, and is a subspecies well worthy of recognition.

The three specimens give the following measurements:

No.	Sex.	Wing.	Tail.	Tarsus.	Exposed Culmen.
19,782	♂ ad.	66.	68.	25.	16.5
19,783	♂ ad.	68.	69.	24.5	17.
19,784	♀ ad.	63.	66.	23.5	16.5

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PROCEEDINGS

OF THE

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THE REPTILES AND BATRACHIANS OF VICTORIA AND REFUGIO COUNTIES, TEXAS.

BY JOHN K. STRECKER, JR.

Baylor University, Waco, Texas.

This paper contains a partial list of the reptiles and batrachians of Victoria and Refugio counties, which are situated in the coast region of southern Texas. While neither county reaches the gulf coast proper, the southeastern part of Victoria touches Lavaca Bay, and Refugio has quite a coast line along San Antonio and Copano bays. To Hon. J. D. Mitchell of Victoria, Victoria County, is due the credit for the work in that county and I am much indebted to him for notes and specimens. During the years 1896 and 1897 Mr. James J. Carroll collected a number of reptiles in Refugio County. These are now in the Baylor Museum, but are all in a poor state of preservation. During 1904 I spent the period from March 10th to April 1st at a point about five miles from the town of Refugio. During my stay I collected quite a series of reptiles, but on account of the drouth I found very few batrachians. On June 20th of the same year I returned and devoted thirty days to collecting. This last visit was productive of splendid results as I succeeded in obtaining a number of interesting batrachians and several species of snakes, lizards and turtles that I had not found during my previous stay.

Refugio, the county-seat of Refugio County, is an old mission town, and is commonly referred to by the natives as "the mission."

1. Species found in both counties.

REPTILES.

Alligator mississippiensis Daudin.
Anolis carolinensis Cuvier.
Sceloporus spinosus Wiegmann.
Phrynosoma cornutum Harlan.

Opheosaurus ventralis L.
Cnemidophorus gularis B. and G.
Liolepisma laterale Say.
Eumeces quinquelineatus L.
Eutaenia proxima Say.
Eutaenia elegans marciana B. and G.
Tropidonotus sipedon transversus Hallowell.
Storeria dekayi Holbrook.
Coluber spiloides D. and B.
Pityophis catenifer sayi Schlegel.
Zamenis flagellum flagellum Shaw.
Cyclophis aestivus L.
Lampropeltis getulus holbrooki Holbrook.
Heterodon platyrhinus Latreille.
Elaps fulvius Linn.
Ancistrodon piscivorus Lacepede.
Ancistrodon contortrix L.
Sistrurus miliarius L.
Crotalus atrox B. and G.
Terrapene ornata Agass.
Pseudemys texana Baur.
Chelydra serpentina Linn.
Aromochelys tristycha Agass.
Aspidonectes emoryi Agass.

BATRACHIANS.

Ambystoma microstomum Cope.
Siren lacertina L.
Bufo lentiginosus americanus LeC.
Bufo compactilis Wieg.
Bufo valliceps Wieg.
Hyla cinerea Daudin.
Acris gryllus crepitans Baird.
Engystoma carolinense Holbrook.
Rana pipiens Shreber.
Rana catesbiana Shaw.

2. Species recorded from Refugio County only.

REPTILES.

Holbrookia propinqua B. and G.
Sceloporus consobrinus B. and G.
Eumeces tetragrammus Baird.
Tropidonotus clarkii B. and G.
Tropidonotus rhombifer Hallowell.
Salvadora grahamiae B. and G.
Kinosternon louisianae Baur.

BATRACHIANS.

Bufo debilis Girard.
Smilisca baudinii D. and B.
Scaphiopus holbrooki Harlan.
Scaphiopus couchii B. and G.

3. Species recorded from Victoria County only.

REPTILES.

Glauconia dulcis B. and G.
Eutaenia sirtalis L.
Tropidonotus sipedon fasciatus L.
Haldea striatula L.
Lampropeltis doliatus gentilis B. and G.
Lampropeltis doliatus doliatus L.
Farancia abacura Holbrook.
Sistrurus catenatus consors B. and G.
Crotalus horridus L.
Kinosternon flavescens Agass.
Pseudemys elegans Wied.

BATRACHIANS.

Diemyctylus viridescens Raf.
Diemyctylus meridionalis Cope.
Chorophilus triseriatus Wied.
Hyla squirella Bosc.

Notes.

Alligator mississippiensis Daudin.

The alligator is still tolerably common in some portions of Refugio County, notably on the Mission River several miles below the town of Refugio and in some of the small lakes. I have the skull of a twelve-foot specimen shot on Sous Creek.

Holbrookia propinqua B. and G.

There is a single specimen in the Baylor Museum, collected on a small rocky cliff on the Arroyo Blanco, about six miles from the mission, by James J. Carroll.

Sceloporus consobrinus B. and G.

I found this lively little fence lizard quite common on Mr. Barber's place, about five miles from the mission, but did not see it anywhere else. Most of my specimens were captured on rail-fences and around old logs in the woods. Mr. Barber's wood-pile yielded me an adult pair. These specimens were all very dull colored.

Opheosaurus ventralis L.

Mr. Mitchell informs me that both the lineated (western) and checkered (eastern) forms of the glass snake occur at Victoria.

Cnemidophorus gularis B. and G.

All of the lined swifts I collected in Refugio County are very typical *gularis*, although I had expected to find *sexlineatus* the prevailing form.

Femoral pores, 16 to 19.

Eumeces quinquelineatus L.

I was surprised to learn from Mr. Mitchell that this lizard was common in Victoria County. I saw but one specimen in Refugio. It was of the "fasciatus" (young) type of coloration.

Eumeces tetragrammus Baird.

One typical specimen from near Refugio.

Eutaenia sirtalis L.

On the list furnished me by Mr. Mitchell, this snake is called *Eutaenia sirtalis sirtalis* L. on the authority of Dr. Stejneger. Some of the specimens submitted to me by Mr. Mitchell were fairly typical *sirtalis*, but two half grown examples were very near the variety *parietalis* Say. I obtained a large series of *Eutaenias* in Refugio County, but did not succeed in collecting any specimens of this variety.

Tropidonotus clarkii B. and G.

A mutilated specimen of a longitudinally banded *Tropidonotus* found near Copano Bay is referred to this species.

Tropidonotus sipedon fasciatus L.

None of the water snakes collected by me are referable to this subspecies, but Mr. Mitchell has sent me a very typical adult specimen from Victoria. I found the subspecies *transversus* Hallowell very common along the water courses in Refugio County, and later Mr. Mitchell secured specimens near Victoria. As a rule the two varieties do not occur together.

Tropidonotus rhombifer Hallowell.

Very common in Refugio County. This species is very prolific. I have 36 young specimens about five inches in length that were taken from the body of a female thirty-four inches long.

Haldea striatula L.

Mr. Mitchell recently sent me an adult female containing seven embryos. This is our only record.

Coluber spiloides D. and B.

This large Coluber is an abundant species in both counties and is notorious as a destroyer of young fowls. On Mr. Barber's farm I captured a large specimen in the act of robbing a turkey's nest. It had already swallowed one egg, but on being disturbed, disgorged it. Mr. James J. Carroll tells an amusing incident of one of these snakes. He had collected a number of hawk's eggs and after removing their contents, laid them in a plate and placed them near a window to dry. He left the house for a short time and on his return found that one of the eggs had disappeared. He retired to the next room and remained perfectly quiet for a few minutes, and was rewarded by the appearance of a Coluber, which at once attempted to steal a second egg-shell but was summarily disposed of by the indignant ornithologist.

Farancia abacura Holbrook.

In November, 1905, Mr. Mitchell sent me a description of a snake captured at Aloe, Victoria County. From the description, I referred it to Farancia. Later, Dr. L. O. Howard, Entomologist of the U. S. Department of Agriculture, examined the specimen and confirmed my identification. This is, I believe, the first authentic record of its occurrence in Texas.

Sistrurus catenatus consors B. and G.

In the transactions of the Texas Academy of Science for 1902 (p. 27) Mr. Mitchell reports the capture of a specimen of this species at Victoria.

Rev. A. H. Barber informs me that a rattlesnake, from the description of which I take to be this species, is found in the coast region of Refugio County, near Copano Bay.

Crotalus adamanteus Beauvois.

This species is recorded by Mr. Mitchell as having formerly been rather common in the timbered belts along the coast region in Harris, Matagorda, Lavaca, Jackson, Victoria and Calhoun counties. He states that its habits are different from those of *Crotalus atrox* which occurs in the prairie district of the same section.

Crotalus horridus L.

Mr. Mitchell writes me that five specimens of this rattlesnake have been taken in Victoria County since 1902.

Kinosternon louisianae Baur.

I collected a typical specimen of this turtle on the Arroyo Medio, about five miles from Refugio.

Kinosternon flavescens Agassiz.

Mr. Mitchell has collected several specimens at Victoria. Two of these are now in the Baylor Museum.

Chelydra serpentina L.

Dr. A. E. Brown in his list of Texas reptiles (Texas reptiles and their faunal relations. Proc. Acad. Nat. Sci., Phila., 1903, p. 552) excludes this species on the ground that he has seen no record of exact localities. I have collected specimens at Burnet, Burnet County, Waco, McLennan County, San Antonio, Bexar County and in Bee and Refugio counties. Mr. Mitchell has collected it in his county, also.*

Bufo debilis Girard.

I collected a single specimen in Refugio County during a heavy rain. It was the only one noted during my stay.

Hyla squirella Bosc.

Mr. Mitchell recently captured two specimens at Victoria, one of which he kindly presented to me. He informs me that the color, in the living specimen, was pale canary.

Hyla cinerea Daudin.

Mr. Mitchell sent me a rather peculiar, light colored specimen which he informed me was yellow in life. It is rather heavier built than the average *H. cinerea*, but otherwise shows little variation from the ordinary type. This species varies in color from yellow and light pea-green to dark oil-green; the labial stripe and spots from white to deep yellow.

* I have a specimen of *Xerobates berlandieri* Agass. from a point in Live Oak County much farther north than the southern part of Refugio, and natives of the latter county who have examined it claim that it occurs there also.

Smilisca baudinii D. and B.

Three specimens from Mr. Barber's farm near Refugio. One of these was found hanging to the side of a frame building, the others were captured on the ground, in the woods.

Chorophilus triseriatus Wied.

One specimen of the "*clarkii*" (spotted) type from Victoria.

Scaphiopus holbrooki Harlan.

Cope states that the range of the eastern spadefoot includes Texas, but in all the herpetological literature at my disposal I fail to find mention of a single specimen having been collected at any point in the State. One night in June, 1904, I collected a typical adult, together with numerous specimens of *Bufo compactilis* Wieg., *Bufo valliceps* Wieg. and *Scaphiopus couchii* B. & G., in a wooded pasture near Mr. Barber's home.

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PROCEEDINGS

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A PRELIMINARY ANNOTATED LIST OF THE BATRACHIA OF TEXAS.

BY JOHN K. STRECKER, Jr.

Baylor University, Waco, Texas.

The writer has been actively engaged for a number of years in working out the distribution of the Reptilia and Batrachia in Texas, with a view of publishing a check-list of the species inhabiting the State. This paper presents a list of the batrachians that have been recorded from within the State limits, and is now published in the hope that others may be able to supply records for any species that may be here omitted. Several of the salamanders inhabiting southern Louisiana undoubtedly occur in the eastern part of Texas, but to judge from the published records, very little work has been done in that section of the State. Several unrecorded species may also enter the northeastern section from Arkansas. I have personally collected material in the central, southern and western portions of the State, in the following counties: McLennan, Falls and Burnet (central), Refugio and Bee (southern) and Midland, Jeff Davis and Brewster (western). I have collected a few species in other counties, but those above mentioned are the only ones in which I have made extended research.

Hon. J. D. Mitchell has furnished me with specimens and notes from Victoria County. Mr. Julius Hurter of the St. Louis Academy of Science has kindly written me out a list of the batrachians collected by him on his several trips into the State. Messrs. C. H. T. Townsend and Charles M. Barber have furnished me with material from El Paso.

The principal works I have referred to for localities are as follows:

S. F. Baird: "Reptilia (and Batrachia) of the Mexican boundary survey" (1).

E. D. Cope: "Check-list of North American Reptiles and Batrachians" (2); "The Zoological position of Texas" (3); "The Batrachia of North America" (4).

M. C. Dickerson: "The Frog Book" (5).

H. C. Yarrow: "Check-list of North American Reptiles and Batrachians" (6).

Various authors: Scattered papers in magazines and the transactions of scientific societies.

Where no name follows a locality, the record is my own.

Batrachia Caudata.

1. **Siren lacertina** L.

GREAT SIREN; MUD EEL.

The siren has an extensive range in eastern and southern Texas. It undoubtedly occurs in all the counties bordering on the Gulf of Mexico and is found as far west in the Lower Rio Grande Valley as the Devil's River. How far into the interior its range extends, I can not say; but I am positive, from descriptions of an animal given me by fishermen, that it occurs as far west as Tyler, Smith County.

Upson, Maverick County (Albert Turpe[4]).

San Diego, Duval County (William Taylor[4]).

Victoria and Calhoun counties (Mitchell).

Refugio County.

2. **Typhlomolge rathbuni** Stejn.

TEXAS BLIND SALAMANDER.

Type and only locality, subterranean waters at San Marcos, Hays County. In a living specimen of this curious animal, the gills and branchiae were light red in color.

3. **Ambystoma opacum** Gravenhorst.

MARBLED SALAMANDER.

Northern and north-central Texas. This species is apparently rare. Cope mentions specimens from one locality, and my records include two others.

Wichita County, near the Red River (Jacob Boll[3]).

Paris, Lamar County (Hurter).

Hewitt, McLennan County.

4. **Ambystoma punctatum** Linn.

SPOTTED SALAMANDER.

The only locality I can find for this species is rather indefinite. It is based on a specimen in the U. S. National Museum collected by Col. J. D. Graham "between Indianola and El Paso"![4]

5. **Ambystoma tigrinum** Green.

TIGER SALAMANDER.

The southern, west-central and western portions of the State. Cope referred a specimen from El Paso, in the National collection, to the western subspecies, *A. tigrinum californiense* Gray. Another one from San Elizario, El Paso County, was recorded under the head of typical *tigrinum.*

The only record I can find for any locality in southern Texas is that of Baird and Girard in Proc. Acad. Nat. Sci., VI., Oct., 1852, p. 173. (Description of the type specimen of *Ambystoma prosperina* B. & G., from the Salado River, one of the tributaries of the Neuces, in the southern part of the State.)

In addition to the above localities, I have seen specimens from Lampasas and Burnet counties (west-central) and Garza (western).

6. **Ambystoma microstomum** Cope.

SMALL-MOUTHED SALAMANDER.

This species is quite common in some sections of the State. The following are the published records, with the addition of my own:

Northern: Paris, Lamar County (Hurter); Dallas, Dallas County (Cope[3]).

North-central: McLennan and Falls counties.

West-central: Burnet County.

Southern and southwestern: Houston, Harris County (Cope[3]); Victoria County (Mitchell), Refugio County.

7. **Ambystoma texanus** Matthes.

TEXAN SALAMANDER.

Central and southern Texas. I have not seen the original description of Matthes' *Salamandra texana*, and have no record of the type locality. Baird's specimens from the "Lower Rio Grande" may refer to the series of eleven specimens collected at San Antonio by Col. J. D. Graham[4] (U. S. Nat. Mus. collection). McLennan County, one specimen.

8. **Plethodon glutinosus** Green.

VISCID SALAMANDER.

This species doubtless has a wide range in the State, but published records of its capture are exceedingly rare.

New Braunfels, Comal County (Capt. Van Vliet[4]).

Bexar County. (Cope[3], "It is found on the first plateau as far as Helotes.")

McLennan County.

9. **Diemyctylus viridescens** Raf.

AMERICAN NEWT.

Mr. Mitchell informs me that this species occurs in Victoria County (specimens identified by Dr. Stejneger).

A specimen of the form *miniatus* in the U. S. National Museum collection, collected by Dr. B. F. Shumard, is labeled "Brazos River, Texas."

10. **Diemyctylus viridescens meridionalis** Cope.

TEXAS NEWT.

The central and southern portions of the State.

San Diego, Duval County (William Taylor[4]).

San Antonio (H. P. Attwater) and tributaries of the Medina River (G. W. Marnock[3]) in Bexar County.

Victoria County (Mitchell).

McLennan and Falls counties.

Batrachia Salientia.

11. **Bufo punctatus** B. & G.

SPOTTED TOAD.

This toad is widely distributed in Texas, but does not occur in the eastern and southeastern portions of the State.

Dallas (Dickerson[5]).

McLennan and Burnet counties.

Fort Concho, Tom Green County and San Antonio (Cope[3]).

El Paso, El Paso County (Townsend and Barber).

12. **Bufo debilis** Girard.

GREEN TOAD.

The following records of the occurrence of this species were published by Cope:

Upper Wichita River (Isaac[3]), "West of Neuces" (G. W. Marnock[3]) and Duval County (William Taylor[4]).

I have personally collected it in the following counties: McLennan, Burnet, Refugio and Bee; and have received specimens from Bexar.

13. **Bufo compactilis** Wieg.

SPADE-FOOT TOAD.

This interesting batrachian ranges from the upper Wichita River in northern Texas to the Rio Grande in the south, and from the southeastern coast counties westward to the Pecos region.

Northern: Wichita River (Boll[3]).

Central: McLennan and Burnet counties.

Western: Ringgold Barracks (A. Schott[4]), Pecos River (Pope[4]).

Southern and southeastern: Indianola (Capt. Pope[4]), Brownsville (Capt. Van Vliet[4]), Victoria County (Mitchell), Refugio County.

14. **Bufo cognatus** Say.

SAY'S TOAD.

I can find no published records of specific localities for this species. I have examples from El Paso, collected by Mr. Charles M. Barber. It is probably common in some portions of the great Pan Handle section of the State, but this district, from a herpetological standpoint, is almost unknown.

15. **Bufo lentiginosus americanus** Le Conte.

AMERICAN TOAD.

Abundant in all sections of the State, excepting the extreme western part. I have personally collected it as far south as Refugio County and as far west as Burnet.

16. **Bufo lentiginosus woodhousei** B. & G.

WOODHOUSE'S TOAD.

I have collected this subspecies in Jeff Davis and Brewster counties, and Mr. C. M. Barber has sent me specimens from El Paso. The specimen from Fort Worth, figured on plate XXV of Miss Mary C. Dickerson's "Frog Book," is not my conception of *woodhousei* as represented in the Baylor University collection by specimens from Utah, New Mexico and El Paso. Large overgrown specimens of a dark colored form of *americanus* are exceedingly common in central Texas, in districts below five hundred feet elevation. The variability of the central Texas toads of this type is exceedingly great. One form is very like *cognatus* in many respects.*

17. **Bufo valliceps** Wieg.

WIEGMANN'S TOAD.

This toad is more or less common in all the counties bordering on the Gulf, from Louisiana to the mouth of the Rio Grande. In the interior I have collected it as far north as Bosque County and west to Llano. My specimens are from the following counties: Victorio, Refugio and Bee (southern); Bosque, McLennan, Burnet and Llano (central).

18. **Engystoma carolinense** Holbrook.

NARROW-MOUTHED TOAD.

The range of this interesting batrachian is extensive, covering fully two-thirds of the State. The only sections from which I have no records are the Pan Handle and the western mountain district.

Northern: Paris (Hurter), Dallas (Cope[3]).

Central: McLennan, Falls, Burnet and Robertson counties.

West-central: Fort Concho (Cope[3]).

Southern and southeastern: Victoria County (Mitchell), Hitchcock, Galveston County (Dickerson[5]), Houston and San Antonio (Cope[3]), Refugio County.

19. **Engystoma texense** Girard.

TEXAS NARROW-MOUTHED TOAD.

Type specimen from Rio Seco, Texas (Capt. Pope[5]). Miss Dickerson[5] mentions specimens from San Diego, Duval County (Taylor) and Brownsville, Cameron County. All of these localities are in the southern part of the State. I have some doubts as to the validity of this form as a distinct

* *Bufo aduncus* Cope (Bull. U. S. Nat. Mus., 1889, No. 34, p. 457), based on a single specimen collected at Gainesville, Cooke County, is here omitted. This specimen, formerly U. S. Nat. Mus. No. 14,100, has been lost. Cope's description indicates a very peculiar variation from the *americanus* group, if not a distinct species.

species. In McLennan County I find two types of *Engystoma*, but have always considered them as mere variations of the same thing. A smooth, dull colored form is fully as common as the brown, tubercular skinned variety. The examination of a large series of specimens from the southern part of the State may lead me to adopt Miss Dickerson's views, so in deference to the excellent discrimination she has otherwise shown in her work, I here include *Engystoma texense* in my list.

20. **Hypopachus cuneus** Cope.

TAYLOR'S TOAD.

This species has been recorded from two localities in southern Texas, *i. e.*, San Diego (Taylor[4]) and Brownsville (Dickerson[5]).

21. **Acris gryllus crepitans** Baird.

WESTERN CRICKET FROG.

I have collected or observed specimens of this species in every county I have visited. Fort Worth is my northernmost record, and I have obtained specimens as far south as Refugio and as far west as Boracho, El Paso County.

22. **Chorophilus ornatus** Holbrook.

ORNATE CHORUS FROG.

Cope[3] has recorded specimens of this species from Dallas (Boll) and Helotes (Marnock) under the name of *C. ocularis* Daudin.

23. **Chorophilus occidentalis** B. & G.

WESTERN CHORUS FROG.

Reported from two localities in the northern part of the State, *i. e.*, Dallas and the upper Wichita River (Boll[3]).

24. **Chorophilus triseriatus** Wied.

STRIPED TREE FROG.

With the exception of the extreme western part, this species appears to be distributed throughout the State. The spotted variety from Indianola, described by Baird as *Holoecetes clarkii*, is also abundant in central Texas, occurring in the same localities as the typical form. The following are recorded localities:

Indianola (Baird[1]), Helotes, Fort Concho, Dallas and Galveston (Cope[4]). My localities are Victoria and Falls counties, Waco, Burnet, and Refugio.

25. **Hyla squirella** Bosc.

SOUTHERN TREE FROG.

This interesting tree frog occurs in southern Texas, but its range is evidently not very extensive. I have specimens in my collection from Victoria and San Antonio.

26. **Hyla cinerea** Daudin.

GREEN TREE FROG.

This species has a wide range and has been collected in the following localities:

Indianola (Baird[1]. Types of *H. semifasciata*).

Victoria (Mitchell).
New Braunfels, San Antonio, Dallas, Helotes (Cope[4]).
McLennan, Bosque, Falls, Burnet and Refugio counties.

27. **Hyla arenicolor** Cope.

Hyla copii Boulenger, from El Paso, described in the Annals and Magazine of Natural History for 1887, p. 53, is referred to this species by Cope.*

28. **Hyla versicolor chrysoscelis** Cope.

WESTERN TREE FROG.

Cope first described this form as a variety of *Hyla femoralis* Lat. It has a wide distribution in Texas but does not appear to be common in any locality.

Cope [4] records specimens of *Hyla versicolor* from Gainsville (Ragsdale) and New Braunfels (Lindheimer) and specimens of *Hyla femoralis* Lat. *var chrysoscelis* [3] from Dallas. All of these specimens should probably be referred to *chrysoscelis*. Waco specimens of this variety are indistinguishable from specimens from Hot Springs, Arkansas, identified by Dr. Stejneger. Mr. C. S. Brimley of Raleigh, N. C., writes me that he has received specimens of this type (*versicolor*) from San Antonio.

29. **Smilisca baudinii** Dum. & Bibr.

VAN VLIET'S TREE FROG.

Baird described specimens of this tree frog from Brownsville under the name of *Hyla vanvlietti*. It is a rare species and occurs only in the extreme southern portion of the State. In addition to the specimens from Brownsville mentioned by Baird, Cope[3] records it from Helotes and I have collected it near Refugio.

30. **Lithodytes latrans** Cope.

ROBBER FROG; BARKING FROG.

Described from specimens collected by Marnock at Helotes, Bexar County. I have collected one specimen at Waco. This curious frog is probably widely distributed, but on account of its peculiar habits is rarely seen. In Burnet and Brewster counties I frequently heard a peculiar barking noise which I was satisfied was the voice of a frog. I was told by the natives that this noise was made by the "bull" lizard (*Crotaphytus*), but I knew this to be untrue as I had captured dozens of these lizards and I had never known them to emit the slightest sound.

31. **Syrrhopus marnochii** Cope.

MARNOCK'S FROG.

Helotes, Bexar County, is the type and only locality, so far as is now known.

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* Cope [4] mentions a specimen of *Hyla regilla* B. & G. from Ringgold barracks as being in the U. S. National Museum. No reference to this specimen is made by Frederick Cleveland Test in his paper, "Variations of the tree frog *Hyla regilla*" (Proc. U. S. Nat. Mus., Vol. 21) although he lists the entire series in the National collection. *Hyla regilla* is not likely to occur in Texas, so Cope's record may have been based on a specimen wrongly labelled or on an example of some other species of *Hyla*.

32. **Scaphiopus holbrooki** Harlan.

SOLITARY SPADEFOOT.

On June 24, 1904, I collected a specimen of this species near Refugio, Refugio County. This specimen is now in the collection of Baylor University and is probably the first to be recorded from the State.

33. **Scaphiopus couchii** B. & G.

COUCH'S SPADEFOOT.

This is the common spadefoot of central, southern and western Texas. I have found it very abundant during favorable seasons in McLennan, Burnet, Bee and Refugio counties. Mr. C. M. Barber sent me specimens collected at El Paso, with the information that it was quite common in that locality. Cope[3] records it from Atascosa and Bexar counties and Miss Dickerson[5] from Brownsville.

34. **Scaphiopus hammondii** Baird.

HAMMOND'S SPADEFOOT.

Reported from Helotes by Cope[3]. I have specimens from El Paso, collected by Mr. C. M. Barber.

35. **Scaphiopus hammondii bombifrons** Cope.

PLAIN'S SPADEFOOT.

U. S. Nat. Mus. No. 3703, from the Llano Estacado, Texas, Capt. John Pope, collector, was referred to this form by Prof. Cope.

36. **Rana catesbiana** Shaw.

BULL FROG.

The bull frog is common in eastern, central and southern Texas, but does not occur in the western part of the State. J. D. Mitchell reports it from Victoria, J. J. Carroll from Polk County. I have personally collected specimens in Falls, McLennan, Bexar, Robertson, Burnet, Smith and Refugio counties.

37. **Rana areolata areolata** B. & G.

TEXAS GOPHER FROG.

This species has been collected at Indianola (Baird[1]) and Hitchcock (Dickerson[5]). These localities are in the southeastern part of the State, in the coast region. *Rana areolata* must be exceedingly rare as the two localities mentioned are the only ones of which I can find any record.

38. **Rana pipiens** Schreber.

LEOPARD FROG.

39. **Rana sphenocephala** Cope.

SOUTHERN LEOPARD FROG.

The literature relating to these two species (or varieties?) is in such an unsatisfactory state that at the present time I am unwilling to attempt

to define the range of either one. Leopard frogs are found all over the State but it is possible in only a few instances to determine to which form the published records refer. I have collected specimens at Refugio and Burnet that I can refer with certainty to *sphenocephala*, but these collected at Waco all seem to be typical *pipiens*. If the two forms *are* distinct species, they probably occur together through the greater part of their Texas range.

Specimens collected in the mountains of Jeff Davis and Brewster counties are too young for satisfactory determination, but adult leopard frogs from El Paso are near to *Rana pipiens austricola* Cope, if not that subspecies.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NOMENCLATORIAL STUDIES IN THREE ORCHID GENERA.*

BY A. A. EATON.

During the course of nomenclatorial studies in the Orchidaceæ I have found the following changes necessary in order to conform with the articles of the Vienna Code. These changes will be more fully discussed and a full bibliography given, with synonomy and keys to the genera, in Orchidaceæ, fascicle 3, now ready for the press.

EPIPACTIS (Haller) Böhmer.

The name *Epipactis* appears to have been first used since 1753 by Böhmer in the third edition of Ludwig's Definitiones Generum Plantarum. Although he makes no binomial combination, his genus is properly made and he gives several references to the plant designated by Linnaeus as *Satyrium repens*, now known as *Goodyera repens* R. Br., or *Peramium repens* Salisb. As the name *Epipactis* antedates all others for the group it must be adopted. The resulting changes in specific names are as follows:

E. angustifolia (Schlechter).

Goodyera angustifolia Schlechter in Schumann & Lauterbach Nachtr. Fl. Südsee 92 (1905).

E. bifida (Bl.).

Neottia bifida Blume Bijdr. 408 (1825).—*Goodyera bifida* Blume Fl. Java Orch. 33, t. 9 | c, f. 1 (1858).

E. biflora (Hook. f.).

Goodyera biflora Hooker f. Fl. Brit. Ind. **6:** 114 (1890).

E. brachiorrhynchos (Schlechter).

Goodyera brachiorrhynchos Schlechter in Schumann & Lauterbach Nachtr. Fl. Südsee 93 (1905).

E. colorata (Bl.).

Neottia colorata Blume Bijdr. 409 (1825).—*Goodyera colorata* Blume Fl. Java Orch. 31 t. 9 | b, f. 2 (1858).

* Contributions from the Ames Botanical Laboratory, No. 8.

E. cordata (Lindl.).
Georchis cordata Lindley Gen. et Sp. Orch. 496 (1840).—*Goodyera cordata* Nicholson Dict. Gard. **2**: 810 (1888).

E. discoidea (Reichb. f.).
Rhamphidia discoidea Reichb. f. in Linnaea **41**: 59 (1876).—*Goodyera discoidea* Schlechter in Schumann & Lauterbach Nachtr. Fl. Südsee 94 (1905) in obs.

E. Erimae (Schlechter).
Goodyera Erimae Schlechter in Schumann & Lauterbach Nachtr. Fl. Südsee 93 (1905).

E. foliosa (Lindl.).
Georchis foliosa Lindley Gen. et Sp. Orch. 496 (1840).—*Goodyera foliosa* Benth. ex Hooker f. Fl. Brit. Ind. **6**: 113 (1890).

E. formosana (Rolfe).
Goodyera formosana Rolfe ex Hemsley in Ann. Bot. **9**: 159 (1895).

E. fumata (Thw.).
Goodyera fumata Thwaites Enum. Pl. Ceylon 314 (1861).

E. fusca (Lindl.).
Goodyera fusca Lindley in Wall. Cat. no. 7395 (1832).

E. glauca (J. J. Sm.).
Goodyera glauca J. J. Smith Nachtr. 1, Orch. Java in Bull. Dept. Agric. Ind. Néerl. no. 13, p. 17 (1907).

E. gracilis (Hook. f.).
Goodyera gracilis Hooker f. Fl. Brit. Ind. **6**: 112 (1890).

E. grandiflora (Schlechter).
Goodyera grandiflora Schlechter in Engl. Bot. Jahrb. **39**: 57 (1906).

E. grandis (King & Pantl.).
Goodyera grandis King & Pantling Orch. Sik.-Him. 284 t. 379 (1898).

E. hacijoensis (Yatabe).
Goodyera hacijoensis Yatabe in Tokyo Bot. Mag. **5**: 1, t. 19 (1891).

E. Hemsleyana (King & Pantl.).
Goodyera Hemsleyana King & Pantling in Journ. As. Soc. Beng. **64**: 342 (1895).

E. Henryi (Rolfe).
Goodyera Henryi Rolfe in Kew Bull. 1896, p. 201.

E. hispida (Lindl.).
Goodyera hispida Lindley in Journ. Linn. Soc. **1**: 183 (1857).

E. lanceolata (Ridl.).
Goodyera lanceolata Ridley in Journ. As. Soc. Straits Br. no. 39, p. 86 (1903).

E. Lehmanniana (Kränzl.).
Goodyera Lehmanniana Kränzlin in Engl. Bot. Jahrb. **26**: 498 (1899).

E. macrantha (Maxim.).
Goodyera macrantha Maxim. in Gartenflora **16**: 36, t. 533, f. 2 (1867).

E. macrophylla (Lowe).
Goodyera macrophylla Lowe Prim. Fl. Madeira 13, t. 1 (1831).

E. Matsumurana (Schlechter).
Goodyera Matsumurana Schlechter in Bull. Herb. Boiss. ser. 2, **6:** 298 (1906).

E. Maurevertii (Bl.).
Goodyera Maurevertii Blume Fl. Java Orch. 35 (1858).

E. nebularum (Hance).
Cystorchis nebularum Hance in Journ. Bot. **21:** 232 (1883).—*Goodyera nebulara* Rolfe in Journ. Linn. Soc. **36:** 45 (1903).

E. ochroleuca (Bailey).
Goodyera ochroleuca Bailey in Bull. Dept. Ag. Queensl. **14:** 15, t. 4 (1896).

E. papuana (Ridl.).
Goodyera papuana Ridley in Journ. Bot. **25:** 355 (1886).

E. parviflora (Bl.).
Neottia parviflora Blume Bijdr. 408 (1825).—*Goodyera parviflora* Blume Fl. Java Orch. 29, t. 22, f. 1 (1858).

E. pendula (Maxim.).
Goodyera pendula Maxim. in Bull. Acad. St. Petersb. **32:** 623 (1888).

E. Polygonoides (Mueller).
Goodyera Polygonoides Mueller Fragm. **8:** 29 (1873).

E. Prainii (Hook. f.).
Goodyera Prainii Hooker f. Fl. Brit. Ind. **6:** 112 (1890).

E. procera (Ker.).
Neottia procera Ker-Gawl in Bot. Reg. t. 639 (1822).—*Goodyera procera* Hooker Exot. Fl. **1:** t. 39 (1823).

E. pubescens (Willd.).
Neottia pubescens Willd. Sp. Pl. **4:** 76 (1805).—*Goodyera pubescens* R. Br. in Ait. Hort. Kew. ed. 2, **5:** 198 (1813).

E. pusilla (Bl.).
Goodyera pusilla Blume Fl. Java Orch. 31, t. 9 | b, f. 3 (1858).

E. recurva (Lindl.).
Goodyera recurva Lindley in Journ. Linn. Soc. **1:** 183 (1857).

E. repens var. **ophioides** (Fern.).
Goodyera repens var. *ophioides* Fernald in Rhodora **1:** 6 (1899).

E. reticulata (Bl.).
Neottia reticulata Blume Bijdr. 409 (1825).—*Goodyera reticulata* Blume Fl. Java Orch. 30, t. 9 | b, f. 1 (1858).

E. robusta (Hook. f.).
Goodyera robusta Hooker f. Fl. Brit. Ind. **6:** 113 (1890).

E. rubicunda (Bl.).
Neottia rubicunda Blume Bijdr. 408 (1825).—*Goodyera rubicunda* Lindley in Bot. Reg. 1839, Misc. p. 61.

E. Schlechtendahliana (Reichb. f.).
Goodyera Schlechtendahliana Reichb. f. in Linnaea **22:** 861 (1849).

E. scripta (Reichb. f.).
Rhamphidia scripta Reichb. f. in Linnaea **41:** 67 (1877).—*Goodyera scripta* Schlechter in Engl. Bot. Jahrb. **39:** 58 (1906).

E. striata (Reichb. f.).
Goodyera striata Reichb. f. in Linnaea **18:** 409 (1844).

E. subregularis (Reichb. f.).
Georchis subregularis Reichb. f. in Linnaea **41:** 67 (1877).—*Goodyera subregularis* Schlechter in Engl. Bot. Jahrb. **39:** 58 (1906).

E. tesselata (Lodd.).
Goodyera tesselata Loddiges Bot. Cab. t. 952 (1827).

E. triandra (Schlechter).
Goodyera triandra Schlechter in Bull. Herb. Boiss. ser. 2, **6:** 298 (1906).

E. velutina (Maxim.).
Goodyera velutina Maxim. in Gartenflora **16:** 38, t. 533, f. 1 (1867).

E. viscosa (Reichb. f.).
Goodyera viscosa Reichb. f. in Linnaea **41:** 61 (1876).

E. vittata (Lindl.).
Georchis vittata Lindley in Journ. Linn. Soc. **1:** 184 (1857).—*Goodyera vittata* Benth. ex Hooker f. Fl. Brit. Ind. **6:** 113 (1890).

E. Waitziana (Bl.).
Goodyera Waitziana Blume Fl. Java Orch. 35, t. 9 | d, f. 2 (1858).

SERAPIAS L.

The genus *Serapias* of Linnaeus is composite, consisting of *Cephalanthera, Epipactis* (Adanson em. R. Br., not Böhmer) and *Serapias* as restricted by Swartz. The first two genera have been segregated and the residue of the original genus now bears the name. It has been customary to leave to the final residue of segregation the original name, but this is contrary to Article 45 of the Vienna Code, provided the type or origin of the group is not contained therein. The type of the genus *Serapias* L. is *S. Helleborine*, an aggregate consisting of species of *Cephalanthera* and *Epipactis* Adans., genera shown by Wettstein to be inseparable. This type is fixed by Linnaeus in Gen. Pl. ed. 5 (1754) as t. 249 of Tournefort, which represents *S. grandiflora*. The name *Serapias* must therefore be restored to the *Cephalanthera-Epipactis* group. The following changes are necessary:

S. africana (Rendle).
Epipactis africana Rendle in Journ. Bot. **33:** 252 (1895).

S. Austinae (A. Gr.).
Chloraea Austinae A. Gray in Proc. Am. Acad. **12:** 83 (1876).—*Cephalanthera Austinae* Heller Cat. N. A. Pl. ed. 2, 4 (1900).

S. Chloidophylla (Reichb. f.).
Cephalanthera Chloidophylla Reichb. f. in Linnaea **25:** 228 (1852).

S. consimilis (Don).
Epipactis consimilis Don Prodr. 28 (1825).

S. cucullata (Boiss. & Heldr.).
Cephalanthera cucullata Boiss. & Heldr. ex Reichb. f. Orch. Eur. 137, 185, t. 120 (1851).

S. gigantea (Doug.).
Epipactis gigantea Douglas ex Hooker Fl. Bor. Am. **2**: 202, t. 202 (1839).

S. kurdica (Bornm.).
Cephalanthera kurdica Bornm. ex Kränzl. in Bull. Herb. Boiss. **3**: 143 (1895).

S. longibracteata (Bl.).
Cephalanthera longibracteata Blume Fl. Java Orch. 159, t. 65, f. 3 (1858).

S. sessilifolia (Peterm.).
Epipactis sessilifolia Peterm. in Flora **27**: 370 (1844).

S. somaliensis (Rolfe).
Epipactis somaliensis Rolfe in Dyer Fl. Trop. Afr. **7**: 189 (1898).

SERAPIASTRUM Kuntze.

The genus heretofore known as *Serapias* must become *Serapiastrum*, with the following combinations:

S. cordigerum (L.).
Serapias cordigera L. Sp. Pl. ed. 2, 1345 (1763).

S. Lingua (L.).
Serapias Lingua L. Sp. Pl. ed. 1, 950 (1753).

S. longipetalum (Tenore).
Helleborine longipetala Tenore Fl. Neap. Prodr. 53 (1811).—*Serapias longipetala* Poll. Fl. Veron. **3**: 30 (1814).

S. neglectum (De Not.).
Serapias neglecta De Notaris Rep. Fl. Ligust. 389 (1844).

S. parviflorum (Parl.).
Serapias parviflora Parl. in Giorn. Sci. Litt. Sicil. **59**: 66 (1837).

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PROCEEDINGS

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THE REPTILES AND BATRACHIANS OF McLENNAN COUNTY, TEXAS.

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McLennan is one of the north-central counties of Texas, with an area of 1,080 square miles. Waco, the county-seat, where most of my collecting has been done, is located in the central part, on the Brazos River, and has an elevation of something over 400 feet.

The eastern and southern portions are low. From Waco southward into Falls County, the country is rich bottom-land drained by the Brazos River and Tehuacana Creek and with occasional ponds and small grassy lagoons scattered here and there. The principal timber is post-oak and pecan. In this district, here denominated the post-oak country, three species of reptiles and a batrachian (*Anolis carolinensis* Cuvier, *Ophisaurus ventralis* L., *Tropidonotus fasciatus* L., and *Diemyctylus viridescens meridionalis* Cope) are found, that do not occur in other portions of the county. *Crotalus horridus* L. and *Eumeces quinquelineatus* L. are rather common, although rare in other sections.

From Waco westward to Gatesville, Coryell County, the elevation steadily increases. At Hewitt, only nine miles from the city, the altitude is 656 feet, and at McGregor, eighteen miles distant, 713. The handsome ring-necked lizard (*Crotaphytus collaris* Say) has been collected in Coryell County only a short distance from the line and it is merely a matter of time when it will also be collected in McLennan.

The Bosque country is the name here used to designate the northwestern section in which is located the villages of Crawford and China Springs. This district commences at the Bosque

River, three miles north of Waco, and extends into Bosque County, in a northwesterly direction. The elevation at China Springs must be at least 250 feet higher than at Waco. This section is hilly and broken. *Holbrookia maculata lacerata* Cope is a species peculiar to it and my only specimens of *Sceloporus consobrinus* B. & G. and *Rhinochilus lecontei* B. & G. are from here.

In McLennan County the main water-course is the Brazos River, which runs through it in a southeasterly direction. On the east side, about nine miles south of Waco, Tehuacana Creek joins the river. The Bosque flows into the Brazos about three miles north of Waco. This stream is formed by three branches, the North, South, and Middle Bosque rivers. The North Bosque is the principal one of the three, flowing through from Bosque County on the northwest.

Childress Creek, in the northeastern section, runs into the Brazos River about six miles above the mouth of the Bosque. Waco Creek and Barron's Branch, two small streams, flow through Waco. The first mentioned is active about ten months of the year, but the second is hardly more than a wet-weather stream.

The Bosque system has a number of small tributaries, including Harris's, Bullhide, Flat-Rock, Hog, and Steele creeks.

At one time there was a good-sized grassy lagoon known as "Dry Pond," about two miles east of Waco. During my first few years of collecting this was my favorite resort. Here I collected my first specimens of *Elaps fulvius* and *Tropidonotus rhombifer* and witnessed a migration of turtles. About seven years ago the lagoon was drained and a levee thrown up and all the glories of my serpent "Eden" have departed.

A number of small natural and artificial lakes are scattered through the county. Most of these are owned and kept up by fishing clubs.

The "Laguna Lake" mentioned several times in this paper is a series of connecting lagoons in the northern part of Falls County, not far from the McLennan County line. Through the courtesy of Messrs. Polk Williamson, the former, and James H. Harrison, the present, president of the "Laguna Lake Club" I have been allowed to collect there on several occasions.

I first began collecting reptiles in the fall of 1893, but it was

five years later when I first made the attempt to form a permanent collection. The species collected prior to 1898 were exchanged for other material, so that, at the present time, my collection lacks four of the species enumerated. These are *Lithodytes latrans* Cope, *Diadophis regalis* B. & G., *Ambystoma opacum* Gravenh. and *Osceola doliata doliata* L. of which only one specimen each has been collected. All of the other species are represented by from one to a dozen or more specimens. This collection is now the property of Baylor University.

A preliminary list of 59 species of McLennan County reptiles and batrachians was read before the Texas Academy of Science at its annual session in December, 1901, and was published in the Transactions of the Society for that year. One mistake occurs in this list. *Pseudemys concinna* LeConte should have been *P. texana* Baur or *P. elegans* Wied., both of which I have collected since 1901. I have ascertained that *P. concinna* does not occur in Texas. The *Pseudemys mobilensis* recorded from the State by several authors is probably *Pseudemys texana*, which has a wide range in Texas.

The present paper records 75 species and subspecies of reptilia and batrachia as occurring in McLennan County. Several subspecific names of doubtful validity used in my former paper are here discarded.

Anolis carolinensis Cuvier.

GREEN LIZARD.

The little pink-throated Anolis is exceedingly rare. In the spring of 1899 I collected two specimens about eight miles south of Waco, between the Brazos River and Tehuacana Creek. On June 12, 1906, Mr. Hurter and I obtained a third example in the woods bordering the north end of Laguna Lake.

Holbrookia texana Troschel.

TEXAN SPOTTED LIZARD.

This beautiful species is more or less abundant in suitable localities throughout the northern and western sections of the county. Its principal haunts are rock quarries and the banks of streams. It is especially abundant along Flat-Rock Creek, where it lives around and under large flat stones lying along the banks. In the fall months a large number of whip snakes (*Zamenis flagellum*) resort to this place to feed on the lizards. I was once chasing an adult *Holbrookia* down the side of a steep bank, when a *Zamenis* darted out from behind a clump of weeds and seized the lizard and I captured both reptiles at the same time. The eggs are from eight to twelve in number and are deposited in hard ground to a depth of five

or six inches. The breeding season extends from May to August. Breeding females are brilliantly colored, the whole underparts being suffused with bright crimson. The nuptial colors in the male are sulphur yellow.

Holbrookia maculata lacerata Cope.

BOLL'S SPOTTED LIZARD.

Between China Springs and Crawford this lizard is rather common. In 1894 three specimens were collected on the Brazos River, near the mouth of the Bosque, but since that time no others have been found there. A female collected at China Springs in May deposited six eggs in the loose earth in the box it was confined in. These eggs are similar to those of *H. texana*, but are much smaller. The nuptial colors in this species are very brilliant.

Sceloporus spinosus Wiegmann.

TEXAS SCALY LIZARD; TREE SWIFT.

This large tree lizard is abundant along the wooded banks of rivers and streams. The adults bask on the trunks of rough-barked trees, at the slightest alarm ascending to the higher branches. In the fall young specimens are usually to be found around old logs and at the bases of rotten stumps. The eggs of this species range from four to eight in number, and are deposited under the bark or in crevices of fallen trees. Young specimens are very light in color but display the distinctive pattern of the adult at a very tender age. One afternoon in May, 1906, I shot forty adult specimens in one small grove near Waco Creek.

Sceloporus consobrinus Baird and Girard.

WESTERN FENCE LIZARD.

This lizard is quite rare. I have collected three specimens in the Bosque hills, in the northern part of the county. I was told that it also occurred in the eastern section, but specimens collected there prove to be young examples of *spinosus*.

Phrynosoma cornutum Harlan.

TEXAS HORNED "TOAD."

Common along roadsides and in grassy flats and fields. These little horned lizards feed principally on red ants, and some of the specimens I have dissected were fairly gorged with these pests. The usual number of eggs deposited by this species is twenty-four. On the 10th of July, 1906, Mr. Whipple, the engineer at the University, discovered a female *Phrynosoma* preparing her nest in the hard earth at the rear of the engine house. He notified me of his find and the next morning we provided ourselves with a spade and pair of heavy shears and went out to collect the set. The hole had been excavated to a depth of seven inches. The eggs formed a compact mass about 2½ inches across and an inch in depth and there was just enough dirt between to keep them from being in contact with each other. Another nest discovered at Gurley, Falls County, in the month of April, 1907, was quite different. The eggs were merely deposited in a small hollow, under cover of an old railroad tie, and had little or no dirt

to keep them separated. A number of these lizards breed in our athletic field each year, and from the 1st of August to the middle of September young specimens just out of the egg are exceedingly abundant.

Opheosaurus ventralis Linn.

GLASS SNAKE.

This animal is rare. A fine example in the University museum was collected six miles south of the city of Waco.

Cnemidophorus gularis Baird and Girard.

WESTERN LINED LIZARD.

Abundant, especially in the flats where they burrow under the roots of mesquite bushes. Femoral pores 16 to 19.

Cnemidophorus sexlineatus Linn.

SIX-LINED LIZARD.

I have collected a few typical specimens of this eastern species along the left bank of the Brazos River, between the First Street Cemetery and Gurley's bottom.

Liolepisma laterale Say.

GROUND LIZARD.

Very common in the bottoms, living among dead leaves and around and under stumps and fallen trees.

Eumeces quinquelineatus Linn.

RED HEAD; BLUE-TAILED LIZARD.

This lizard is rare in the immediate neighborhood of the city of Waco, but in the post-oak country it is as common as *Sceloporus spinosus.*

Eumeces obsoletus Baird and Girard.

WESTERN SKINK.

Three half-grown examples of this species were collected among rocks, not far from McGregor.

Glauconia dulcis Baird and Girard.

WORM SNAKE.

On July 22, 1907, Mr. W. T. Gooch found a specimen of this species lying dead in a path on the Baylor Campus, only a stone's throw from the Science Hall. It was in a preservable condition and could not have been dead over an hour at the outside.

Diadophis regalis Baird and Girard.

WESTERN RING-NECKED SNAKE.

One specimen from near Dry Pond, in east Waco. In this paper, following Arthur Erwin Brown, I drop the subspecific name *arnyi*, which I formerly applied to this snake. Cope clearly admitted that *arnyi* was merely a color variation.*

* "Crocodilians, lizards and snakes of North America," p. 745 ("Resembles *D. regalis*, from which it will be distinguished by color").

Heterodon platyrhinus Latreille.

BLOWING ADDER.

This species is rather common in the Brazos-Tehuacana bottoms, but rare in the immediate neighborhood of Waco.

Cyclophis aestivus Linn.

SOUTHERN GREEN SNAKE.

Tolerably common in the wooded Brazos and Bosque bottoms.

Zamenis constrictor L.

BLACK SNAKE; RACER.

This species in its typical form is exceedingly rare. One specimen from the Bosque hills north of Waco was a typical *constrictor*, black, with slate-colored belly. All of the other specimens I have seen were referable to the following subspecies:

Zamenis constrictor flaviventris Say.

YELLOW-BELLIED RACER.

Two specimens of this variety from the prairie district between Waco and McGregor, three from the Symes farm on the Brazos about ten miles south of the city, and a single example from Proctor Springs were olive-green with the under surfaces bright yellow.

Zamenis flagellum Shaw.

COACHWHIP SNAKE; PRAIRIE RUNNER.

A common species in the prairie districts. This is one of our most beneficial serpents, for while they destroy a good many lizards, they more than make up for it by the number of locusts they consume. I have collected examples that were fairly gorged with specimens of *Schistocerca americanum*.

Coluber spiloides Duméril and Bibron.

TEXAS PILOT SNAKE.

Abundant wherever there are wooded tracts and one of our most harmful species. On account of their expertness in climbing trees, they annually destroy large numbers of young birds. I have known them to almost depopulate a small colony of Cliff Swallows, and on one occasion killed a specimen that had just swallowed a female scissor-tailed flycatcher and her eggs.

Coluber obsoletus lindheimeri Baird and Girard.

LINDHEIMER'S PILOT SNAKE.

My friend, Mr. J. P. Bahl, kindly presented me with a fair sized specimen of this bright colored pilot snake which he collected near McGregor. This is my only record for the county.

Pityophis catenifer sayi Schlegel.

BULL SNAKE.

This species is not uncommon in the prairie district between Waco and McGregor. I once witnessed an aerial combat between a snake of this

species and a large hawk. The hawk had carried the serpent some distance from the ground, but the latter squirmed so vigorously and struck at its captor so furiously that the bird was forced to relinquish its hold. When the reptile struck the ground I supposed that it would be too badly stunned to move, but on my reaching the spot where it had fallen I was just in time to see it dragging its body slowly down the burrow of some fossorial mammal.

Lampropeltis doliatus doliatus L.

SCARLET SNAKE.

I collected a specimen of this beautiful species nearly ten years ago, but I have never been able to find a second one.

Lampropeltis calligaster Say.

EVANS' KING SNAKE.

This species, one of the handsomest of North American serpents, is exceedingly rare in McLennan County, which locality, I believe, marks the southern limit to its range.* The specimen from Waco in the U. S. National Museum (No. 21,486) and one other now in the Baylor University collection, are the only examples of the species I have ever captured. In life, the blotches on the upper surface of this species vary from deep chestnut brown to deep red, in different specimens.

Lampropeltis getula sayi Holbrook.

WESTERN KING SNAKE.

The king or "speckled" snake is rather common. In Waco examples the markings are seldom in the form of bands, but the whole upper surface is minutely speckled with small yellow dots. My observations indicate that this species feeds entirely upon other snakes.

Rhinochilus lecontei Baird and Girard.

LE CONTE'S SNAKE.

I captured one specimen of this beautiful snake about midway between Waco and China Springs. Two other serpents which I supposed to be this species were seen in the same locality.

Tropidonotus rhombifer Hallowell.

DIAMOND WATER SNAKE.

This handsomely marked water snake is common in tanks and lagoons. Along the creeks, however, it is less abundant than *T. transversus*.

Tropidonotus sipedon transversus Hallowell.

HALLOWELL'S WATER SNAKE.

Our most abundant water snake. The specimen listed in my former paper as *T. erythrogaster* Shaw was probably an obsoletely marked example of this subspecies. A number of adult specimens of *transversus*

* Since the above was written I have seen Cope's record of a specimen collected at Fort Davis, Jeff Davis County. This would indicate that its range extends south almost to the Rio Grande River.

collected at Waco and Burnet during the summer of 1906 show hardly any trace of the distinctive markings of this variety, but vary from muddy yellow to brick red in color. This leads me to believe that *erythrogaster* is merely the adult form of *transversus*.

Tropidonotus sipedon fasciatus Linn.

RED-BELLIED WATER SNAKE.

This fine snake is not found at Waco, but I have obtained specimens in the Tehuacana bottoms. At Laguna Lake it is fully as common as *T. rhombifer*. Living specimens are brilliantly colored, deep shades of red and yellow prevailing.

Tropidonotus grahami Baird and Girard

GRAHAM'S WATER SNAKE.

Exceedingly rare. Some years ago I captured one specimen near the mouth of the Bosque River, and in April, 1906, collected a second example at Laguna Lake. The Laguna specimen was found coiled up under the bark of a rotten log.

Storeria dekayi Holbrook.

DE KAY'S SNAKE.

This small species, while tolerably common around Waco, is much more abundant in the post-oak country and at Laguna Lake.

Haldea striatula L.

BROWN SNAKE.

This little snake is quite common under logs and among masses of decaying wood, in thickly timbered bottoms. Waco examples are grayish-brown above, yellowish-white beneath.

Tropidoclonium lineatum Hallowell.

This species is abundant in the city limits of Waco, and almost every large woodpile and old building has its quota of specimens. After a big fire I collected 27 specimens around the water-soaked debris and am satisfied that I could have obtained many more had I tried.

Salvadora grahamiae Baird and Girard.

GRAHAM'S SNAKE.

An adult specimen from west of Waco is in the Baylor University collection. A friend gave me a living specimen some years ago, but it escaped before I had time to consign it to spirits. These two examples are the only ones I have any record of.

Eutaenia proxima Say.

SAY'S GARTER SNAKE.

This species is our commonest garter snake, and as a rule is the least variable. In life the dorsal stripe is usually a rich red in color.

Eutaenia marciana Baird and Girard.

MARCY'S GARTER SNAKE.

In May, 1897, I captured an adult specimen of a spotted garter snake on the flats west of Waco and sent it, with other material, to my friend, C. S. Brimley, of Raleigh, N. C. Brimley identified it as *marciana* and sold it to a German Museum under that name; but afterwards expressed himself as being a little doubtful of the identification. Since then I have collected good series of typical *marciana* in western and southern Texas, and have been satisfied for a long time that Brimley's original identification was correct, but nevertheless was highly pleased when two more fine specimens from Waco were brought in last November. One of these was found under a pile of old lumber on the University campus.

Eutaenia eques Reuss.

REUSS' GARTER SNAKE.

I have collected about six specimens in the country during the past ten years. The difference between examples from central and western Texas is very marked, and Cope was fully justified in recognizing two color varieties.

Eutaenia sirtalis sirtalis Linn.

Eutaenia sirtalis parietalis Say.

Garter snakes of the *sirtalis* type are exceedingly rare in this section of Texas, and it is almost impossible to find a perfectly typical specimen of either of the above subspecies. In my former paper I referred two *Eutaenias* to *dorsalis* Baird and Girard, which name is a synonym of *parietalis* Say. One of these was a fairly typical specimen of Say's subspecies, but I made my reference to the other with considerable doubt as it seemed very like *sirtalis*, although I had been led to believe, through my reading, that the typical subspecies was not found in this part of Texas. In answer to a letter of inquiry written to Dr. A. E. Brown, Director of the Zoological Society of Philadelphia, regarding some of his authorities, I was referred to one of Cope's papers which recorded the occurrence of *E. sirtalis sirtalis* near Dallas. Since that time I have collected three specimens, all of which are referable to *sirtalis*.

Tantilla gracilis Baird and Girard.

GRACEFUL TANTILLA.

This species must be very rare here as I have found but one during all my years of collecting. In life this specimen was light golden-brown above, reddish underneath.

Elaps fulvius Linn.

HARLEQUIN SNAKE.

This handsome snake is not uncommon. Damp places near springs and the vicinity of small streams are its favorite resorts, for in these places its food, which consists largely of other snakes, is usually abundant. In

one of these specimens I dissected I found three adult *Haldea striatula.* Another one contained a small *Tropidonotus.*

Ancistrodon piscivorus Lacepede.

COTTON MOUTH.

Tolerably common around Waco, but is much more abundant in the post-oak country and at Laguna. Specimens from central Texas are much darker than those from further east, and the bands never display reddish tints. I have never found more than seven embryos in any of the females I have dissected.

Ancistrodon contortrix Linn.

COPPERHEAD.

Tolerably common in the wooded river bottoms, but of late years has become very scarce in the more cultivated districts.

Sistrurus miliarius Linn.

GROUND RATTLESNAKE.

On August 5, 1907, while we were camped at Mussel Island on the North Bosque River, Gooch found a specimen of this pretty little rattlesnake under an old newspaper lying in the middle of our camp.

Crotalus atrox Baird and Girard.

TEXAS RATTLESNAKE.

The Texas rattlesnake is exceedingly rare. In July, 1905, a large specimen over six feet in length was killed near China Springs and brought to Waco.

Crotalus horridus Linn.

BANDED RATTLESNAKE.

In my former paper I recorded one specimen of this rattlesnake. Since then I have discovered that it is the prevailing form of *Crotalus* in this section of central Texas. It is rather common in the post-oak country between Waco and Laguna. It also occurs near China Springs, and I have had one specimen from McGregor. The specimens I have examined have shown considerable variation in color. In life the ground color of one was light buff, a second, bright yellowish tawny, and a third (now in the Baylor Museum) light salmon.

Pseudemys texana Baur.

TEXAN TURTLE.

This fine turtle is probably rare, as I have only collected two examples. One of these was caught in the Bosque River, in a seine; the other one was found in a fisherman's net at Laguna.

Pseudemys elegans Wied.

ELEGANT TURTLE.

Common in most of our streams and rivers; exceedingly abundant at Laguna Lake.

Graptemys geographica LeSeur.

MAP TURTLE.

Rare. My first record was based on a poorly preserved specimen found in a lot of material collected by Prof. O. C. Charlton. Afterwards I captured two specimens in the North Bosque River.

Terrapene ornata Agass.

PAINTED BOX TORTOISE.

Very common on the flats west of the city of Waco. At one time I had three specimens of this species and made it a rule to feed them regularly at the same hour each day. Finally I turned them loose in my back yard and every evening about six o'clock they would come to me to be fed. It was laughable to watch them as they stood on their hind legs, scratching at my shoes and the bottom of my trousers in their endeavor to attract my attention. I fed them on raw beef cut into strips, and as soon as their appetites were satisfied they would go back to their quarters under the coal shed and I would not see them again until about the same time the next evening. The natural diet of this species consists of vegetable matter and earthworms.

Chelydra serpentina Linn.

SNAPPING TURTLE.

Tolerably common in the Brazos and Bosque Rivers.

Kinosternon flavescens Agass.

YELLOW MUD TURTLE.

I have only collected two examples of this species in McLennan County. One of these was found half buried in the mud of a small prairie sink, the other was captured on the dam at Day's Lake.

Kinosternon louisianae Baur.

LOUISIANA MUD TURTLE.

This species is abundant in the lagoons and streams. In 1893 I witnessed a migration of these turtles at Dry Pond. The marsh was rapidly drying up, and as I walked along the levee I counted 45 specimens all headed in the same direction. At first I thought that they were merely changing their quarters to the ditch along the railroad track only about 200 yards away, but found that there was very little water there, and that turtles were scattered all over the damp meadow on the other side. I followed the line of march and discovered that they were headed for a large tank over half a mile from Dry Pond.

Aromochelys tristycha Agass.

TEXAS MUSK TURTLE.

This turtle is rare in the neighborhood of Waco, but very common at Laguna Lake.

Aspidonectes emoryi Baird and Girard.

EMORY'S SOFT-SHELL TURTLE.

This fine soft-shell turtle is abundant in the Brazos and Bosque Rivers.

Ambystoma microstomum Cope.

SMALL-MOUTHED SALAMANDER.

This salamander is rather rare in the immediate neighborhood of Waco, but is quite common in the Tehuacana bottoms and at Laguna.

Ambystoma texanum Matthes.

TEXAN SALAMANDER.

My only example of this rare species was found about five miles south of Waco. The following is a brief description of this specimen:

Baylor University Museum (Strecker collection, No. 2316). Total length, 119 mm. Length to vent, 62½ mm. Color, light brown above, sides and under parts yellow; traces of light spots between the costal grooves. Head oval, rather flattened and broad; fourteen distinct costal folds; a distinct median dorsal groove. When the fore and hind legs are extended and appressed to the sides they are separated by four of the intercostal spaces (six in *A. microstomum*). Width of head at jaws contained four times in total length to groin (six and a half times in *microstomum*).

Ambystoma opacum Gravenhorst.

MARBLED SALAMANDER.

The specimen from Hewitt mentioned in my former paper constitutes my only record for this handsome species.

Plethodon glutinosus Green.

VISCID SALAMANDER.

Exceedingly rare. I have one specimen from the Tehuacana bottom. This makes the second one I have collected in the county.

Diemyctylus viridescens meridionalis Cope.

TEXAS NEWT.

This newt is by no means a common species. During the last two years a few examples have been caught in small lagoons east and south of Waco. Mr. Hurter and I obtained a few specimens at Laguna Lake in June, 1906.

Scaphiopus couchii Baird and Girard.

COUCH'S SPADE-FOOT.

After the first heavy rain in April or May these interesting batrachians come forth from their burrows and make the streets of Waco resound with their loud cries. As a rule they delay their appearance until about dusk, but I have known them to come out as early as three o'clock in the afternoon. The male makes quite a conspicuous object when he has his vocal vesicle fully distended. They breed in temporary pools, usually going into the water in April and May. The eggs are in strings and are attached to weeds or grass after the manner of those of some *Bufos*. During the past fourteen years I have handled a great number of these burrowing toads. The most of these were collected in their breeding pools, but specimens are brought in every few days from March to November, by persons who dig them up while working in their gardens and flower

pits. In damp weather I have found a few specimens around the electric lights in company with *Bufo compactilis* and *Bufo americanus*. In life the ground color in different examples of this species varies from yellow-green to dark green. Most of the male specimens are of the cross-barred type.

Lithodytes latrans Cope.

ROBBER FROG; BARKING FROG.

In 1899 I captured one of these curious little frogs. I found it hopping along a gutter an hour or two after a heavy shower. This species is said to inhabit rocky places. On one occasion while I was working the limestone bluffs along Flat Rock Creek I saw two frogs that I am satisfied were of this species, but they escaped by jumping into a deep crevice, and I was without the necessary implements to get them out. The ground color of the upper surface, in my specimen, was light green.

Bufo lentoginosus americanus LeConte.

AMERICAN TOAD,

Our common toads are a puzzling lot. Some seem to be typical *americanus*, others are near *woodhousei*, while a third type, represented by a few light-colored specimens, show many characteristics of *cognatus*. I lump them all under the same head at present, intending later on to make a more critical examination of our extensive series of toads of this species.

Bufo valliceps Wiegmann.

NEBULOUS TOAD.

This interesting and peculiar species is rather common but less so than specimens of the *americanus* type. I capture quite a number around electric lights and have no difficulty in selecting them from among the numerous specimens of other species, on account of their alert manner and the peculiar upright position they assume when in repose. At some points along the rocky banks of some of the small streams tributary to the Bosque River I have found these toads in considerable numbers. Here they inhabit caves and fissures in the soft shaly stone, and feed largely on the long-legged monstrosities commonly known as "grand-daddies."

Bufo debilis Wiegmann.

GREEN TOAD.

The habits of this interesting little species resemble those of *Scaphiopus couchii* in many respects. They are night-prowlers, seldom moving around until after dark, then coming forth from their burrows under the roots of mesquite trees on the grassy flats, in quest of their food. In life the ground color of the upper surface in this species varies from light to dark-green, while the underparts are soiled yellowish white. The throat pouch, in the male, is blackish. In this locality I have only collected four or five specimens outside of the mesquite flats. Like the spade-foot, they breed in temporary pools, and after a heavy rain their presence can soon be detected by their peculiar, long-drawn, bird-like notes. I collected twenty-four pairs in copula on the banks of one small ditch.

Bufo punctatus Baird and Girard.

SPOTTED TOAD.

This is our rarest *Bufo*. In the fall of 1904 I found my first specimen under a log in the Brazos bottom. Two years later my friend Rohrer collected a second example, and in May, 1907, I captured a third. The last specimen was collected at night, in a ditch in which numerous specimens of *Scaphiopus couchii*, *Bufo debilis*, and *Engystoma carolinense* were breeding.

Bufo compactilis Wiegmann.

SPADE-FOOTED TOAD.

This is another toad of peculiar habits and on this account was long overlooked. In June, 1905, I found two specimens among some trash, in the small park across the creek from the University. The next month I obtained two more which were attracted by the light of the lantern I was using while sugaring for moths, near the same place. These specimens were all collected in damp weather. In May, 1906, I decided to keep a sharp lookout for this species and spent two nights in collecting around the electric lights, but the only toads I found were specimens of *americanus* and *valliceps*. A few days later we had a series of heavy rains and I tried my luck again, with the result that I collected twenty-five specimens of *compactilis* in less than two hours. Since then I have obtained a great many more, but always in damp weather.

Hyla cinerea Daudin.

GREEN TREE-FROG.

This beautiful green tree-frog is not common in the near vicinity of Waco, but it is quite abundant in the post-oak country and at Laguna Lake.

Hyla versicolor chrysoscelis Cope.

WESTERN TREE-FROG.

This variety of the common eastern tree-frog is exceedingly rare in central Texas. During my fourteen years of collecting in this county I have only captured three examples.

Chorophilus triseriatus Wied.

STRIPED TREE-FROG.

Two color varieties of this species occur in the vicinity of Waco—a large spotted form and the ordinary striped one. In April when these frogs go into the water to breed they fairly swarm in the marshes. On one occasion I collected more than forty specimens at Dry Pond in less than an hour's time. I formerly considered the spotted specimens as representing a subspecies (*C. triseriatus clarkii* Baird and Girard), but the examination of a large series of examples from Illinois and Texas convinces me that this variety is not worthy of recognition. I have found *Chorophilus triseriatus* breeding in temporary pools as well as more permanent bodies of water.

Acris gryllus crepitans Baird and Girard.

WESTERN CRICKET FROG.

Abundant along all of our water courses. Waco specimens of this subspecies are very variable in color, but seldom display greenish tints.

Engystoma carolinense Holbrook.

NARROW-MOUTHED TOAD.

Two types (or varieties, they might possibly be called) of this species occur here, and both appear to be equally common. Type A is greenish-gray in color, with the skin almost smooth; type B is darker, varying from brown to almost black, and with the skin more tubercular. At the present time I refer both of these varieties to *carolinense*, intending to investigate the matter thoroughly as soon as the spring season opens up.

Rana pipiens Schreber.

LEOPARD FROG.

Very abundant in suitable localities. The examination of a large series of frogs of the *Rana pipiens* type from different sections of Texas will probably convince us of the necessity of recognizing one or two of the subspecies described by Cope. *Rana pipiens* Schreber (= *R. virescens* Kalm) in its typical form doubtless occurs in all of the eastern and north-central counties, but specimens I have examined from the southern part of the State, east of San Antonio, are the short-headed type (*Rana virescens brachycephala* Cope). Examples from west of the Pecos would probably be referred to the Mexican form described by Cope under the name of *Rana virescens austricola*.

Rana sphenocephala Cope, as at present defined, is probably a distinct species.

Rana sphenocephala Cope.

SOUTHERN LEOPARD FROG.

In working over my series of leopard frogs I find two specimen that are clearly referable to this variety (or species?). They were collected in July, 1907, on the east side of the Brazos River, in the wooded strip between that stream and Tehuacana Creek.

Rana catesbiana Shaw.

BULL FROG.

This species is not uncommon in the lagoons and along the larger water courses. Last year Rohrer and I captured a half-grown specimen from among a lot of toads that were congregated around an electric light, fully four blocks from the nearest creek. At the same time we saw another specimen but failed to secure it.

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PROCEEDINGS

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NOTES ON THE HABITS OF TWO ARKANSAS SALAMANDERS AND A LIST OF BATRACHIANS AND REPTILES COLLECTED AT HOT SPRINGS.

BY JOHN K. STRECKER, JR.

BAYLOR UNIVERSITY, WACO, TEXAS.

During the years 1894, 1895 and 1896 I received nearly 250 batrachians and reptiles from Hot Springs, Arkansas. These specimens were collected by my friend, Bert Lawrence Combs, who was killed at Red Oak, Iowa, in the spring of 1897, by a fall from a tree. Young Combs, who was only twenty years of age when he met his untimely end, was an enthusiastic ornithologist, and had he lived might have become eminent in his particular field of science. To his energy, intelligence and generosity I am indebted for many specimens and valuable notes. At his death, in fulfillment of a wish he had expressed several years before, I became the possessor of his books and collection of specimens. A loving, generous soul, may he rest in peace.

The Hot Springs specimens collected by Combs were an interesting lot. They represented 36 species and subspecies, including the types of the salamander described by Dr. Stejneger under the name of *Desmognathus brimleyorum* and four of the five known specimens of the rare *Ambystoma annulatum* Cope.

In this paper I have incorporated his most interesting observations; and give a complete list of the species received from him with my personal comment thereon.

Ambystoma annulatum Cope.

COMBS' SALAMANDER.

Cope described this species under the name of *Linguelapsus annulatus*, from a specimen in the United States National Museum collection. The

type (No. 11,564) was unlabeled and its habitat remained unknown until Combs collected his first specimen in the month of October, 1894. This specimen was presented to me and I disposed of it, through exchange, to Mr. C. S. Brimley. Mr. Brimley sent it to Washington and it is now in the National collection.

Regarding this specimen, Dr. Stejneger made the following comments: "A direct comparison with the type specimen shows the peculiar coloration to be identical, with the trifling exception that in the type the light crossband from arm to arm is interrupted in the middle of the back, while in the new specimen it is continuous like the other crossbands. A pale crossband between the eyes, not mentioned by Prof. Cope, is present in both specimens. The new specimen is comparatively fresh and the ground color appears to have been black, the crossbands silver-gray."*

The other three specimens were sent to me alive. They were the most beautiful salamanders I have ever seen, and I have examined specimens of nearly all of our eastern North American forms. The ground color was shiny black and in two of the specimens all of the crossbands were of a deep sulphur-yellow. In the third example (the female) the anterior bands were yellow, the posterior ones almost white.

The following notes on the capture and breeding habits of this interesting species I am quoting from the letters and field notes of the collector:

"Near the city is a creek which is dry during some seasons but runs in wet weather. At a certain point, about a yard from this creek and lying at the foot of a sweet-gum tree, is a log about ten feet in length. This log is partly imbedded in the mud, very much decayed, and when I first visited it, was almost covered by pine-needles. Under it are large holes made by crayfish. On turning the log over I found the salamander and a king snake." (Oct., 1894. Letter.)

"A couple of days ago I found a second black and yellow salamander in the same place as the last. It was dead and in an advanced stage of decomposition." (Nov., 1894. Letter.)

"I hunted for further specimens of this fine salamander, without success, until the following spring. One night in March we had a severe rainstorm. The next morning, as soon as the sun came out, I made a trip to my log, and on turning it over there lay two of the much-desired batrachians. On my looking closer I could see that one of the two had been depositing some eggs. There were thirty-five of these eggs so far and she continued to deposit more, as she crawled leisurely on, with the male closely following and inspecting each one as it was deposited. The eggs were placed about an eighth of an inch apart. By this time she had almost reached one of the crayfish holes, so I quickly seized her and the male and carefully rolled the log back in place. I secured a water-tight box, filled it half full of mud and water and placed the salamanders in it and they seemed perfectly satisfied. About 4 P. M. that day I decided to take another look under the log, and on again turning it over found a third specimen. The specimens measured eight, five and a half and six inches respectively. [Length of head, body and tail. The tail in the

* Proc. U. S. Nat. Mus., 1894, p. 599.

largest example was almost twice the length of that of the six-inch specimen. At the time they were received I took measurements of the length of head and body to vent of each of the three specimens, but these records have been lost. J. K. S.] After the salamanders had been in captivity about twelve hours the female had deposited a total of 150 eggs. I kept them three days longer in order to study their habits, and found them to be stupid and sluggish. If disturbed they would lie perfectly still and make no attempt to move away, but their neighbors (*Desmognathus*) would run at the slightest alarm. On the fourth day I packed them in damp moss and forwarded them to Strecker. On the fifth day the eggs began to shrivel up, but I poured more water in the box and in a few hours they had resumed their normal condition. On the tenth day the young salamanders began to come out of the eggs. When first hatched they were only about half an inch in length and were similar to larval salamanders that I had seen in Strecker's collection. [Larvæ of *Ambystoma opacum*, from Brimley, if I remember rightly. J. K. S.] I let them remain in the box for a few hours and then released them in a moist place, not far from where I had captured the parents." (Typewritten notes dated June 25, 1895.)

Whether any of Combs' young salamanders survived or not is a question. In late years Mr. Julius Hurter has twice visited Hot Springs in quest of this species, but failed to find them on both occasions, although he was provided with my data. From the above notes, and my study of the living specimens, I have written the following conclusions:

1. Five of the six recorded specimens of *Ambystoma annulatum* Cope were found under the same log, in the woods near Hot Springs, Ark. (The five of course including the dead specimen mentioned in Combs' second letter.)

2. The coloration in the living specimen is black and yellow, instead of black and silver-gray as was suggested to Stejneger by the colors in the preserved specimen.

3. These salamanders inhabit the deserted burrows of crayfish and only come to the surface when the ground is moist.

4. They deposit their eggs on the ground, under logs or among masses of decayed wood.

5. The female keeps her eggs supplied with moisture until they are hatched. I have no doubt but what she carries them down into the ground, to the line of moisture, in exceedingly dry weather. (The question of how the young salamanders are carried into the water or whether they go into the water at all, I am unable to answer.)

6. The eggs are never in strings but are always separate, and as many as 150 may be deposited by the same female.

7. Combs has recorded the fact that his eggs hatched on the tenth day, but I presume this depends entirely upon the amount of moisture they receive.

Combs sent me a few of these eggs. They were slightly over an eighth of an inch in diameter and the embryos were well formed. (Incubation

was about 4½ days at the time they were received.) I supplied them with moisture, but for some reason they never hatched.

Desmognathus brimleyorum Stejn.

BRIMLEY'S TRITON.

The type lot of this species contained nearly forty specimens, all in a rather poor state of preservation, but Combs afterwards sent me a number of finely preserved examples.

At Little Rock Mr. Hurter found *Desmognathus brimleyorum* associated with *Spelerpes multiplicatus* Cope, but with the exception of the small colony under the *Ambystoma* log, no other species was found in company with the Hot Springs specimens. Combs' first specimens were found under the edges of flat rocks in the middle of a rather sluggish stream. Afterwards others were found under planks, logs and rocks, in damp woods in close proximity to water.

The larger specimens are dusky, almost sooty or of various shades of brown, with no distinct markings, while the young examples are typically of a very light yellowish-brown with the upper part of the tail either dull red or pinkish, and are more or less overlaid with dusky spots. Most of the specimens were collected in March, April, October and November, but occasionally a few were found in the summer.

Combs gave the following information in regard to the breeding habits of *Desmognathus brimleyorum :*

"In the latter part of August or early in September the female triton deposits her eggs, which are from 30 to 36 in number, and attached together in strings, in a crevice in the under side of a rotten log or in a mass of decaying wood near some small stream. The eggs are about an eighth of an inch in diameter. The female is much attached to her eggs and seldom goes far away from them. During a dry spell she will carry them down into her hole with her, and if it rains again before they are hatched, will again bring them to the surface."

The following is a complete list of the species and subspecies collected by Combs. Of those marked with a star I have received less than four specimens. The majority of the others were collected in large series.

BATRACHIA.

Ambystoma annulatum Cope.
Combs' salamander.

Desmognathus brimleyorum Stejn.
Brimley's triton.

Plethodon glutinosus Green.*
Viscid salamander.

Bufo lentiginosus americanus LeConte.
American toad.

Engystoma carolinense Holbrook.
Narrow-mouthed toad.

Hyla versicolor chrysoscelis Cope.
Western tree frog.

Chorophilus occidentalis Baird and Girard.*
Western chorus frog.

Rana pipiens Schreber.
Leopard frog.

Rana catesbiana Shaw.
Bull frog.

Rana clamitans Latreille.
Spring frog.

REPTILIA.

Anolis carolinensis Cuvier.
Green lizard.
Sceloporus consobrinus Baird and Girard.
Western fence lizard.
Cnemidophorus gularis Baird and Girard.
Western lined lizard.
Liolepisma laterale Say.*
Ground lizard.
Eumeces quinquelineatus Linn.
Red-head; blue-tailed lizard.
Diadophis regalis Baird and Girard.*
Regal ring-necked snake.
Heterodon platyrhinus Latreille.*
Blowing adder.
Cyclophis aestivus Linn.*
Southern green snake.
Zamenis constrictor Linn.*
Black snake.
Lampropeltis doliatus doliatus Linn.*
Scarlet snake.
Lampropeltis getula sayi Holbrook.*
Western king snake.
Tropidonotus leberis L.
Leather snake.
Tropidonotus sipedon fasciatus L.*
Southern water snake.
Tropidonotus sipedon transversus Hallowell.*
Hallowell's water snake.
Eutaenia proxima Say.
Say's garter snake.
Eutaenia eques Reuss.*
Reuss' garter snake.
Eutaenia sirtalis parietalis Say.
Western garter snake.
Storeria dekayi Holbrook.
De Kay's brown snake.
Haldea striatula L.*
Brown snake.
Tantilla gracilis Baird and Girard.*
Graceful tantilla.
Ancistrodon contortrix L.*
Copperhead.
Ancistrodon piscivorus Lacepede.*
Cotton-mouth.
Crotalus horridus L.*
Banded rattlesnake.
Terrapene carolina triunguis Agassiz.
Box tortoise.
Pseudemys concinna Wied.
Neat turtle.
Chelydra serpentina L.*
Snapping turtle.

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THE HOLOPHYTIC PLANKTON OF LAKES ATITLAN AND AMATITLAN, GUATEMALA.

BY H. WALTON CLARK,

U. S. Bureau of Fisheries.

In the present paper is given a list of the chlorophyl-bearing plankton-elements of the lakes Atitlan and Amatitlan, Guatemala, collected by Dr. Seth E. Meek, of the Field Museum of Natural History, Chicago, during the winter of 1905–1906. Among the material examined were examples of certain plants, *Salvinia natans* (L.), *Ceratophyllum demersum* L., *Ionardia natans* (Ell.) and fragments of *Chara*, which do not belong to plankton.

The holophytic animals are included in this report, partly because they are regarded by some authors as plants, but primarily because plankton studies are essentially ecological rather than taxonomic, the most important division being that which separates the material according to whether it is self-supporting or whether it depends upon organic matter for subsistence.

So far as they could be found, references have been given to publications containing figures of each species listed, and in cases where the original description or other important references could be found they have also been cited.

The attempt has been, not so much to give a complete list of synonyms, as to include, and enable the student to correlate, the names generally known. In looking up the references I have received much assistance from Mr. P. L. Ricker of the U. S. Department of Agriculture, to whom I take this opportunity of expressing my thanks.

The phytoplankton of lakes Atitlan and Amatitlan, so far as the collections indicate, consists exclusively of algæ. None of the minute Lemnaceæ were found: they are, however, usually

taken only in horizontal hauls in sheltered bays, and may on this account have escaped.

The organisms mentioned under the holophytic zooplankton are by some authorities counted among plants, and by others among animals. In some cases the only reason for their being included in the vegetable kingdom appears to be the presence of chlorophyl. In structure they are closely allied to animals everywhere recognized as such and the presence of chlorophyl appears to be simply a physiological adaptation, much as the absence of chlorophyl among parasitic and saprophytic plants is. The structure of various members of the Volvocaceæ is particularly significant in this connection, as the organisms as a whole represent embryonic stages well-known in the animal kingdom and indeed necessary to complete the animal series, while they have no particular significance in the plant series and placed anywhere in that group have always the aspect of foreigners.

In so far as the question of fish food is concerned, or indeed from any point of view, the presence of a small amount of holozoic plankton is much more satisfactory than a large amount of holophytic plankton. A great excess of phyto-plankton is even a disadvantage; in addition to its frequently accumulating in masses as a scum on the surface or along the shore, and there decaying and becoming an offence both to sight and smell, it may sink to the bottom in masses where its decay induces conditions unfavorable to fish life. On the other hand, the presence of holozoic plankton is evidence of at least enough holophytic material to provide food for fishes, and it rarely or never becomes objectionable by its abundance. Most young fishes live on zooplankton, and the phytoplankton is significant mainly as affording pasturage for the zooplankton, and through it for the fish. Even in the case where fishes with herbivorous young are present, the zooplankton offers a more varied food-supply and is of special importance when it comes to the question of introducing other species of fish.

For example, Amatitlan appears to have much more plankton than Atitlan, but unless the young of the fishes of that lake are herbivorous it does not contain nearly so much fish food, as the plankton is mainly holophytic, relatively few entomostraca being present, while in Atitlan, though there is not nearly so much

algæ, entomostraca are quite abundant. Among the holozoic forms, in addition to entomostraca, a rotifer, resembling *Anuræa cochlearis*, is quite abundant, and another, probably *Notholca longispina*, very common.

One of the most striking features of Lake Amatitlan, and perhaps of tropical lakes in general is the indication of "wasserbluethe*" during February, and therefore probably throughout the year. Although the field notes do not make special mention of "wasserbluethe," the presence of *Clathrocystis* and *Anabæna*, both characteristic wasserbluethe plants, together with the notes "abundant on surface," make it almost certain that wasserbluethe is present. This would indicate, also, that probably the same elements of plankton are present and in pretty uniform quantities the year round, so that plankton-taking for a few weeks would be a fair gauge of what was really in the lake at any time. In more northern lakes, or in cooler regions, with extreme seasons, a short series of hauls during a single season would mean almost nothing.

The following is a list of the algæ represented in the collection:

ORDER COCOGONÆ.

1. **Glœocystis rupestris** (Lyngb.).

Palmella rupestris Lyngb., Hydro. Dan., 207, pl. 69, 1819.
Glœcapsa polydermatica Kuetzing, Tab. Phyc., I, 15, Tab. 20, fig. III, 1845; Wolle, F. W. Alg. U. S., 331, pl. CCX, figs. 29–31, 1887.

Glœocystis is very rare in the collection; only one example was noted, this was in a sample of plankton collected from the surface of Atitlan in front of the hotel, February 18, 9 P. M.

It may be remarked that some authors, Wollë in particular, regard this genus as simply the early condition of some higher alga, and place no value on specific distinctions between the various forms. The example seen agrees very well with Wolle's figures and brief description. Compared with Kuetzing's plates it more closely resembles his *quaternata* than any other but in view of the very little significance attached by

* The term "wasserbluethe" is here used to indicate the minute algæ, mostly blue-greens, which come to the surface and form a scum. In this strict sense there was no "wasserbluethe" present. The expression "abundant on the surface," put on many of the labels by me, should have been, "abundant at or near the surface," for nearly all of the algæ so evident to the naked eye were distributed in the stratum of water from the surface to the depth of a meter or more. Where it was driven in masses, apparently by the wind, it nowhere formed a scum on the surface even when the water had been but little if any agitated by the wind for one or more days. "Wasserbluethe" could not be said to exist in the lower half of the lake. The presence of so much *Anabæna flos-aquæ* near the surface in the upper half of the lake certainly indicated that "wasserbluethe" did exist there at least to a limited extent (Meek).

some writers to the species of this genus, I prefer to let it stand among the forms already listed from the American continent.

2. **Microcystis marginata** (Menegh.).

Anacystis marginata Menegh., Nost., 93, Tab. XIII, fig. 4, 1841; Wolle, F. W. Alg. U. S., 329, 1887.

Microcystis marginata, Kuetzing, Tab. Phyc. I, 6, 1845; Kirchner in Eng. and Pr., Nat. Pfl-fam. I, 1a, 56, 1900.

In many of the samples (formalin material) collected in Lake Amatitlan, the solid matter has separated, the heavier material settling to the bottom and the lighter material coming to the top. The surface material is of a bright blue-green color, and is either coarsely flocculent or exceedingly fine in appearance. In case it is coarsely flocculent it is usually composed mainly of *Clathrocystis* (q. v.) along with a few other elements such as *Microcystis, Anabæna, Gomphosphæria* and the like. When it is exceedingly fine in appearance it is found to be mainly *Microcystis*.

In many cases it occurs in the vertical hauls, in which case it was presumably taken mainly in the upper part of the haul. A few colonies often occur, however, in the bottom material. If any wasserbluethe occurs on the Central American lakes it is probably mainly due to this *Anabæna* and *Clathrocystis*. It occurs in large colonies (a colony of medium size measures 1080μ long and 400μ wide) composed of innumerable minute bright blue-green cells 3-5μ in diameter. The families appeared to be indistinctly arranged in minute looping strings, reminding one somewhat of *Clathrocystis*, although no perforations in the colonies were evident.

The identification of this form with *M. marginata* is not perfectly satisfactory, inasmuch as the thin colorless tegument is not in evidence, and the colonies are considerably too large. The latter matter, however, is merely a matter of coherence, closely related to such local influences as winds and calms. The thalli quite closely resemble the figure of *Microhela firma* ("*Palmella firma* Breb. & Lenorm") in Kuetzing's Tabulæ Phycologia.

3. **Clathrocystis robusta** Clark sp. nov.

Diagnosis: Thallus in younger stages a dense spherical colony of dark blue-green spherical or oval cells, 6–9μ in diameter, surrounded by a spherical envelope of refractive jelly. Plant-body in later stages of growth perforate, clathrate or broken up into elongate rounded lobes. Jelly tardily deliquescent, finally wholly dissolving, leaving the plant-body a densely cohering mass of cells. Colonies quite large and conspicuous. Agrees in form and life history with *Clathrocystis æruginosa* Kuetzing, from which it differs in the much greater size of the individual cells. Color in formalin bright blue. Type material Sample No. 1, collected at Lake Amatitlan, Guatemala, February 1, 1906, by Dr. Seth E. Meek.

The type material will be deposited in the U. S. Museum.

This alga is abundant in the surface material of the collections from Lake Amatitlan, forming a flocculent bright blue-green scum. It is at

hand in all stages of growth from that of a relatively small globular colony to the last stage of old age, and they agree with the stages given in the life history of *Clathrocystis æruginosa* (Kuetzing).

Associated with this plant and apparently intimately connected with its life history is a minute filamentous alga which I identify with some doubt as *Anabæna stagnalis* Kuetz. to be more fully discussed later on. The colonies in their earlier stages are usually free from the *Anabæna* or nearly so, but by the time they have reached middle size, and while the contour of the surrounding jelly is still unbroken, the greater number of colonies are more or less infected, many of them containing the *Anabæna* filaments in great numbers. After the jelly has disappeared, the *Clathrocystis* cells still continue to cohere. In this stage the filaments of the invading alga are very much in evidence, forming indeed a very conspicuous part of the colony, projecting from the periphery of the cell-mass thickly in all directions, giving it a bristly appearance. The mingled mass of filaments and globular cells remind one strongly of sections of lichens with their gonidia and accompanying hyphal filaments.

It does not appear that the *Anabæna* filaments exercise any injurious influence on the *Clathrocystis* cells; they appear to be merely aulophytes. Some colonies that contain them in great numbers appear pale, but the greater number appear healthy and robust as before infection. The filaments, moreover, are not closely applied to the *Clathrocystis* cells but lie loose in the jelly. It is probable that they have a good deal to do with the breaking down and deliquescence of the jelly, but this has always been described as a normal event in the life history of *Clathrocystis* colonies, and no accompanying organisms have been mentioned.

The specimens of *Clathrocystis* at hand agree almost perfectly both in form and color with the figures of *Clathrocystis æruginosa* given in Griffith and Henfrey's Micrographic Dictionary, pl. 5, fig. 9d, and with the other figures in the same plate except in color. They agree fairly well with Wolle's figures (plate CCX, figs. 17, 18, 19, F. W. Algæ), except that the colonies are usually broken up into lobate masses instead of being clathrate. The cells of *C. æruginosa* are variously given as 2.5 to 3.5 and 3 to 4μ. those of *C. robusta* attain a diameter of from 6 to 9μ. In both species the colonies vary greatly in size; they probably attain much larger size when there is little wave-motion.

Probably whatever is true of *Clathrocystis æruginosa* in general in relation to the other life of the lake is true of this. The behavior of that species is such that one can hardly speak of its abundance in general terms, or make general comparisons between different bodies of water except in cases where it has been under long periods of observation, as it is likely to be very much in evidence some days and rare at other times. Apstein (Das Süsswasser plankton, 135) gives an interesting discussion concerning *C. æruginosa*, noting its great abundance on a certain occasion, and discusses its probable relation to fish life. He remarks in substance that it is a common opinion that *C. æruginosa*, with other algæ that form wasserbluethe, is injurious to fishes, but asserts that while this may be true in small ponds, that it is certainly not true

in larger bodies of water. He is of the opinion that it forms an important food supply of Entomostraca.

Clathrocystis robusta is usually associated with *Microcystis*, *Anabæna*, and a few entomostraca.

4. **Gomphosphæria aponia** Kuetzing.

Gomphosphæria aponia Kuetzing, Alg. ag. dulc. Dec. XVI, No. 151 ——; Tab. Phyc. I, 22, Tab. 31, fig. III, 1845; Wolle, F. W. Alg. U. S., 328, pl. CCX, figs. 20, 21, 22, 1887; Kirchner, in Eng. & Pr. Nat. Pfl-fam. I, 1a, 56, fig. 49p, 1900.

Frequently found mixed in with the *Clathrocystis*-*Microcystis* scum mentioned above; sometimes present on the surface of the material, usually alone in the form of small brown grains. All forms represented the mature condition, and nearly all were bright yellowish brown in color. Each cell usually exhibited a small dark speck resembling an eyespot.

5. **Merismopœdia glauca** (Ehrenberg).

Gonium? glaucum Ehrenberg, Infus., 58, pl. 3, f. V, 1838.

Merismopœdia glauca Kuetzing, Tab. Phyc., V. 13, Tab. 38. fig. 2, 1855; Wolle, F. W. Alg. U. S., 326, pl. CCX, figs. 12–15, 1887; Kirchner in Eng. & Pr. Nat. Pfl-fam. I, 1a, 57, 1900.

Rare. Only one specimen noted; this was in sample No. 1, "Amatitlan in 85 ft. water, towed in about 75 to 65, February 1, 1906, at middle of upper part of lake." It was associated with numerous other algæ.

ORDER OSCILLATORIACEÆ.

6. **Spirulina tenuissima** Kuetzing.

Spirulina tenuissima Kuetzing, Phyc. Germ., 156, 1845; Tab. Phyc., I, 26, pl. 37, fig. IV, 1845; Wolle, F. W. Alg. U. S., 323, pl. CCX, fig. 3, 1887.

One vial, marked "Jan. 24, dark colored algæ growing in very warm water; left 36 hours, it turned red in bottle, put formal on it then; from upper end of lake," contained a dark blue-green gelatinous stratum consisting almost entirely of filaments of this species. A single filament was also found in a flat gelatinous stratum composed mainly of *Oscillaria* obtained from the surface, between pools of hot water, Laguna, January 13. Diameter of filament (diagonally, along axis of cells) 5μ, short axis of cells 2μ.

The liquid in which the *Spirulina* was kept was of a beautiful amethyst color.

7. **Oscillaria* cruenta** Grunow.

Oscillaria cruenta, Wolle, F. W. Alg. U. S., 312, pl. CCVII, figs. 1–3 and 4–7, and pl. CCVI, fig. 5, 1887.

Abundant, forming a flat gelatinous striated stratum, brownish in

* The name *Oscillatoria* is older than *Oscillaria* and covers a number of the species included in the same genus. As I am unable to find what disposition has been made of these two species in the various revisions through which the group has passed, I leave them under the familiar name *Oscillaria*.

color, about 4 mm. thick, obtained from the surface between pools of hot water, Laguna, January 31.

These filaments do not agree in every respect with any description that could be found, but fit that of *cruenta* more closely than any other. On account of the deviation from the description of that species the following notes are appended:

Filaments slender, 5–8μ in diameter, very light blue-green, with numerous dark brown dots or granulations. No septæ visible; most of the filaments straight, but a great number gracefully undulate; apex bluntly rounded; no coiled forms were seen.

In the jelly mass from which these filaments projected were numerous filaments (*Anabæna stagnalis?*) similar to those found in the *Clathrocystis* colonies, but much longer, the filaments frequently attaining a length of 130μ. There were also present innumerable small cells, probably bacteria.

8. **Oscillaria chlorina** Kuetzing.

Oscillaria chlorina Kuetzing, Phyc. Germ. No. 10; Tab. Phyc., I, 28, 1845; Wolle, F. W. Alg. U. S., 311, 1887.

I identify as this species examples collected by hand and not forming part of the plankton proper. It formed a dirty green, somewhat firm mass, looking much like a fresh-water sponge. Filaments 3μ in diameter, articulations indistinct, the cells about as long as wide.

Order NOSTOCACEÆ.

9. **Anabæna stagnalis** Kuetzing.

Anabæna stagnalis Kuetzing, Sp. Alg., 1849; Tab. Phyc. I, 50, Tab. 93, fig. IV, 1845; Wolle, F. W. Alg. U. S., 288, 1887.

Associated with *Clathrocystis* colonies, as noted above, is a filamentous form, which, after considerable study, I identify with *Anabæna stagnalis* Kuetzing. It resembles in many respects some of Kuetzing's figures of species of *Phormidium*, but all which resemble it are much too large. I have not observed any large heterocysts, which are said to be present in *A. stagnalis*, but otherwise it fits the brief description of that species in Wolle very well. The following notes were taken.

Filaments short, straight, simple (one filament forked somewhat at the end by ending in two diverging cells), usually about 2–8 cells long. Cells usually somewhat elongate, sometimes spherical, turgid. Diameter of filaments 3μ; length of cells about 5μ; length of long filaments about 20μ, color very pale blue-green. Habitat, jelly of *Clathrocystis* colonies.

In a jelly mass surrounding some *Oscillaria* found in one of the samples, much longer filaments (attaining a length of 110μ) of what appears to be the same thing, are abundant. (See under *Oscillaria cruenta.*) It is probable that the firmness of the *Oscillaria* jelly, as well as its freedom from disturbance, permits a much longer growth of this form than in the *Clathrocystis.*

10. **Anabæna flos-aquæ** Brebisson.

Anabæna flos-aquæ Brebisson, "Algues des environs de Falaise. 1835"; Kuetzing Sp. Alg. 289, 1849; Tab. Phyc. I, 51, Tab. 94, fig. IV, 1845; Apstein Süssw-p. 136, fig. 3, 1896; Wolle, F. W. Alg. U. S. 236 (the specimens at hand resemble most closely his figure of var. *circinalis* pl. CXCVIII, figs. 24–26), 1887.

Very common in all the phyto-plankton from Lake Amatitlan, usually found in the *Clathrocystis–Microcystis* scum.

ORDER RIVULARIACEÆ.

11. **Glœotrichia natans** Thuret.

Glœotrichia natans Thuret (Ref. not found); Wolle, F. W. Alg. U. S., 246, pl. CLXXVIII, figs. 4-20, 1887.

This appears in one sample of hand-gathered material, among sponges. The forms at hand are hollow jelly spheres about the size of a hazel-nut and much resembling some of the familiar forms of *Nostoc*. Many of the old, large filaments are brown; but there are many new filaments, some of which are greatly twisted in a rather elongate irregular spiral. The jelly of this species harbors many diatoms and a number of sponge spicules are also present. The plants agree very well with Wolle's description and figures.

CHLOROPHYCEÆ. THE GREEN ALGÆ.

ORDER HYDRODICTYACEÆ. THE WATER NETS.

12. **Raphidium brauni** Nægeli.

Raphidium brauni Nægeli in Kuetzing, Sp. Alg. 891, 1849; Wolle, F. W. Alg. U. S., 198, pl. CLX, figs. 26, 27, 1887.

Not common; several specimens, however, found in material collected from the surface about one hour before dark, Amatitlan, February 16, (Sample 7).

13. **Tetrædron minimum** A. Braun.

Tetrædron minimum Braun. Alg. Unicell. 94, 1855.

Polyedrium minimum, Wolle, F. W. Alg. U. S., 185, pl. CLIX figs. 28–34, 1887.

Not common in the plankton; a few examples were observed in sample No. 6, collected at Lake Amatitlan, February 16, 3 P. M. Diameter of cells from side to side 10μ; diagonal diameter 12μ.

14. **Pediastrum boryanum** (Turpin).

Hierella boryana Turpin, Mem. Mus. Hist. Nat. Paris, 16; 319, pl. 13, fig. 22, 1828.

Pediastrum boryanum Wolle, Desm. U. S., 153, pl. LIII, figs. 29, 32, 1884.

Rare; only one example found, lodged in a mass of *Oscillaria*. In the shape of its cells it resembled Wolle's figure 32. Horns quite short. Diameter of colony seen 70μ, cells 20μ.

ORDER ZYGNEMACEÆ.

15. **Spirogyra maxima** (Hassall).

Zygnema maxima Hassall, Annals of Nat. Hist. X, 36, 1842.
Zygnema orbiculare Hassall, Brit. F. W. Alg. I, 138, pl. XIX, figs. 1, 2, 1845.
Spirogyra maxima Wolle, F. W. Alg. U. S., 218, pl. CXXXIX, figs. 3, 4, 1887.

A large and exceedingly long *Spirogyra*, represented by one vial of rather poorly preserved material, agrees very well with Wolle's description. Pyrenoids prominent, making the spiral bands appear moniliform. Diameter of the specimens at hand 120μ, length of cells 130μ.

Not a plankton species properly speaking. Only the smaller species of *Spirogyra* are occasionaly found freely floating and are taken in the plankton net. All the Spirogyras are, however, intimately associated with plankton, as they form much of the food of rotifers and various insect larvæ.

16. **Spirogyra fluviatilis** Hilse.

Spirogyra fluviatilis Hilse, in Rabenhorst, Fl. Eur. Alg. 3; 243; 1868; Wolle, F. W. Alg. U. S., 216, pl. CXXVI, fig. 1, 1887.

Occurs in two bottles of rather fine filamentous algæ not belonging to the plankton-haul series. The examples agree fairly well with Wolle's description, the chlorophyl bands are broader, and the pyrenoids prominent, giving the bands a somewhat moniliform appearance. Bands about 4, making about 2 turns. Diameter 36μ, length of cells 75μ.

ORDER DESMIDIACEÆ.

17. **Cosmarium retusum** Perty.

Cosmarium retusum Perty, Klein. Lebensf., 208, pl. 16, f. 12 a–d, 1852; Wolle, Desm. U. S., 80, pl. XVIII, figs. 25, 26, 1884.

Not common; a few specimens occurring sporadically in different samples of plankton from Lake Amatitlan. Our specimens agree well with Wolle's figures. One measured 28μ long and 25μ wide at the suture. Wolle gives "diam. of cells about 22μ."

18. **Cosmarium subcrenatum** Hantzsch.

Cosmarium subcrenatum Hantzsch, in Rabenht., Fl. Eur. Alg. 3; 164, 1868; Wolle, Desm. U. S., 84, pl. XVIII, figs. 6, 7; pl. XIX, fig. 20, 1884.

Not abundant, but generally scattered through the plankton samples, one or two individuals occurring on quite a number of the slides from different gatherings. The number of crenulations on the margin do not agree exactly with those mentioned in descriptions, but the examples bear a very close resemblance to published figures. An average specimen measured 24μ long and 22μ wide at the suture.

19. **Staurastrum gracile** Ralfs.

Staurastrum gracile Ralfs, Ann. Nat. Hist. 15; 155, pl. 11, f. 3, 1845; Wolle, Desm. U. S., 133, pl. XLIII, figs. 16, 17, 1884.

Not common, but single individuals were frequently found scattered through the other plankton-algæ of Lake Amatitlan. A few examples were observed dividing. Our average specimens have a length of 40μ, and length of arm 50μ.

20. **Staurastrum evermanni** Clark sp. nov.

Diagnosis: End view a slender, long-armed triangle with concave sides; main axis of the body slender, enlarged into bulbous swellings at the junction of the semi-cells; chloroplasts bright green, regular, following the general form of the group; periderm prickly; length of individual arms from center of body about 55μ; length of the long arms of the H-shaped figure formed by the desmid in side view 110μ; length of axis 40μ, its average width 10μ; arms each ending in stout diverging spines; asexual reproduction of the species, frequent in the material at hand, and, as usual in the group, by the formation of new semi-cells joining the old. Type material, plankton sample No. 14, collected at a surface towing in front of Hotel Laguna, Lake Amatitlan, Guatemala, February 5, at 9 P. M. by Dr. Seth E. Meek.

The type material will be deposited in the U. S. National Museum.

This species is very common in some of the plankton, nearly all the samples containing a few plants, and the type sample contained it in marked abundance. In end view this desmid almost exactly resembles *S. pseudobaldi* Wille, as figured by Wolle (Desm. U. S., pl. XLVI, fig. 9), and the side view is more like that of *S. macrocerum* Wolle (figured in Desm. U. S., pl. XLIII, fig. 4) than any other species of which I can find figures. It differs from that species, however, in the arms being more nearly straight and more slender, and particularly in the elongate, slender body, the ends of which terminate at the junction of the semi-cells in a well-marked bulb-like expansion. I take great pleasure in naming this attractive species for Dr. Barton Warren Evermann, of the U. S. Bureau of Fisheries.

ORDER DIATOMACEÆ.

21. **Epithemia turgida** (Ehrenberg).

Navicula turgida Ehrenberg. Phys. Abh. Akad. Wiss. Berlin, 1830, 64, 1830.

Epithemia turgida Griff. and Henf. Mic. Dict. 299, pl. 16, fig. 32, 1883, Wolle, Diatom, N. A., pl. XXXV, figs. 10–13, 1890, Van Heurck, Treat. Diatom. (Baxter trans.), 294, fig. 66, and pl. 9, fig. 346, 1896; Stokes, Aquat. Mic. 94, fig. 70, 1896. West, Brit. F. W. Alg., 300, fig. 142, 1904.

Rather rare, only occasional specimens having been seen in the gatherings.

22. **Fragilaria crotonensis** Kitton.

Fragilaria crotonensis Kitton, Science Gossip, 110, fig. 81, 1869; Van Heurck, Treat. Diatom., 324, p. 11, fig. 44, 1896.

Several examples which I identify with some doubt as this species were found in sample No. 5, collected February 16, at the depth of 120 feet of St. Lucas. They agree fairly well with Van Huerck's figures.

23. **Melosira crenulata** (Ehrenberg).

Gallionella crenulata Ehrenberg, Phys. Abh. Akad. Wiss. Berl., 1841; 441, pl. 3, fig. 28, and p. 444, pl. 4, fig. 31, 1843.

Melosira crenulata Wolle, Diatom. U. S. pl. LVII, fig. 16–20, 1890; Van Huerck, Treat. Diatom., 443, pl. 19, fig. 618, 1896.

One of the most striking features of the Amatitlan plankton is the abundance of *Melosira*, which is found abundantly in the bottom of nearly all the hauls and usually makes up the main mass of the filamentous material. Samples of the mud from the bottom of the lake are also full of the frustules of this species. Although not agreeing in every respect with the descriptions found of *M. crenulata* it approaches it more nearly than anything else I can find described, and I provisionally identify it as that species. The frustules are, in some cases at least, broader than long (some measured specimens being 20μ in diameter with cells 15μ long) which is not the proportion for *crenulata*, in which the cells are longer than broad. The specimens occur as long, rigid filaments, exceedingly and surprisingly various in diameter. The chloropasts are in the form of green oval bodies about the middle of the cell, so that the general appearance is strikingly like a confervoid alga, the differences only appearing manifest upon sharp focussing which reveals the characteristic diatom sculpture on the cell walls. The old cell walls project from the end of the filament in the form of long sharp needles, one usually being longer than the other, and there are traces of minute teeth along the ends of the filament. As Hassall (Brit. F. W. Alg., I, 397) aptly remarked, "The genus *Melosira* amongst the Diatomaceæ seems to have been constituted with a view of making apparent the affinity between the Diatomaceæ and the algæ proper" (this was written when the relationship of the diatoms was still a matter of doubt, some contending that they belonged to the animal kingdom).

Concerning another species (*varians*) of *Melosira*, Apstein (Süssw-p., 140) makes the following significant remarks, which are also probably applicable in the case of this species:

"*Melosira* habe ich direkt als Nahrung von *Bosminien*, *Daphnien* und *Diaptomus* schon 1892 (Biol. Centralblatt Bd. 12, No. 16, 17, 1 Sept., 1892) nachweisen konnen bei denen ich die zellen dieszer Algen deutlich und zahlreich im Darm sehen konnte."

Order ULOTHRICHACEÆ.

24. **Hormospora** sp.?

Hormospora forms, consisting usually of 4–8 very short dark green cells, arranged in a short filament and surrounded by quite thick cell walls, were

quite common in some of the samples of plankton. Wolle (F. W. Alg. U. S. 189) regards *Hormospora* as a "pseudo-genus" composed of stages of degeneration of filaments of *Ulothrix*, *Conferva*, etc. All the specimens seen were much alike, showing no young stages nor mature forms. Moreover, there was no other alga present that could readily give rise to such forms. This alga was found in samples 4, 5 and 6.

25. **Microspora fontinalis** (Berkeley).

Conferra fontinalis Berkeley, in Sowerby, Eng. Bot. 29, pl. 2054, 1809; Wolle, F. W. Alg. U. S. 141, pl. CCX, figs. 17–20, 1887.

I identify with the species called *Conferva fontinalis* Berk., by Wolle, an alga which occurs somewhat sparsely through the plankton, most abundantly in sample 5, from near St. Lucas, February 16. No form of reproduction was observed, and the chlorophyl is aggregated in the center of the cell, appearing in the form of small elliptical globoids, somewhat suggesting gonidia ready to escape; cell-walls thin; diameter of filament 18μ; length of cells about 190μ.

Precisely the same as the above in structure and appearance, but differing markedly in size (diameter 3.5μ, length of cells 38μ) are forms which would for the present better be regarded as young individuals of the same species. They occur abundantly among the filamentous material of the greater number of samples from Lake Amatitlan.

Wolle gives the characters of "*Conferra fontinalis*" as "diameter of filaments 15–18μ, articulations 6–10 times as long as wide" and reports it from fresh-water ponds and lakes in Florida. In looking up the original description of *Conferva fontinalis*, I find it to be very poorly defined. Wolle's plant does not appear to be the same species, but it is a form with such a complete absence of diagnostic characteristics that I prefer to let it stand as it is.

26. **Conferva gyrans** Clark sp. nov.

Diagnosis: Filaments simple, rather short, consisting of about 3–8 cylindrical cells, the whole plant-form assuming the shape of an open spiral; cells three times as long as wide. Plants exceedingly various in size, the largest being 25μ in diameter with cells 80μ long. Cell walls thin, chloropasts in formalin material bright green, elongate or spherical, arranged irregularly in the center of the cell; ends of filaments truncate, formed by one of the former septæ, the remains of the old cell-walls projecting beyond, and suggesting that the terminal cells may allow their contents to escape as reproductive bodies, and then gradually break down. Type material, plankton sample No. 3. Collected in Lake Atitlan, Guatemala, in front of the hotel, February 18, 1906, 9 P. M., by Dr. S. E. Meek. The type material will be deposited in the U. S. National Museum.

Scattered through the plankton samples from Lake Atitlan, nowhere abundant, but occurring quite commonly in some samples, is an alga which is unlike anything of which I can find any description or figures. The filaments are twisted in the form of a corkscrew, and are very inconspicuous, hardly visible to the naked eye because of their transparency. They

vary greatly in size, some filaments being 25μ in diameter with the cells 80μ long, while others are only 10μ in diameter. The peculiar arrangement of the chlorophyl as described in the diagnosis above may represent the formation of gonidia, but the smaller plants have this arrangement as well as the old. It is probable that the plant is reproducing, and that the gametes or gonidia have recently escaped from the ends of the larger filaments, the peripheral walls of which project considerably beyond the terminal septæ in many instances.

West's notes on the genus *Tribonema*, a generic name which has been proposed for *Conferva* which some authors do not regard as having been sufficiently defined (Brit. F. W. Alg. 256) fit in well with this species and appear to point out pretty clearly where it should belong. The chromatophores are parietal, "Asexual reproduction takes place by globular or ellipsoidal aplanospores and it is related to *Ophiocytium*." In its habit of curling in the fashion of a corkscrew it bears a strong superficial resemblance to *Ophiocytium*, but can be distinguished from the species of that genus at once by the numerous septæ and truncate ends. The peculiar spiral growth, however, is possibly merely physiological, and may be, as Ostenfeld has pointed out in the case of a much curved form of *Melosira granulata* noted in one of the lakes of Iceland (Journ. de Botanique, Bot. Tids. Kjobenhaven, XXVI, fasc. 22, p. 233), "an interesting adaptation to the limnetic condition."

Order ŒDOGONIACEÆ.

27. **Bulbochæte** sp.

A few sterile plants of *Bulbochæte* were found mixed in with the *Glœotrichia*, but on account of their sterile condition, I could not identify them with any degree of certainty. The following notes were made:

Cells rather short and stout, somewhat turgid, the diameter from 15 to 18μ, the length from 25 to 28μ; each living cell contains a bright, large eye-spot, and a number of cells are empty. Filament rather well branched; lateral setæ short with a small bulb; terminal setæ long and slender, occasionally terminating in a clavate expansion.

The following is a list of the holophytic species occurring in the Zooplankton. Besides these, rotifers and entomostracans were present in considerable numbers.

Order FLAGELLATA.

1. **Cœlastrum microporum** Naegeli.

Cœlastrum microporum Nægeli (Ref. not found) Wolle, F. W. Alg. U. S. 171, 1887.

Not uncommon, a few specimens found scattered through samples No. 19 (February 5, Amatitlan, towing made at noon from bottom to top in 110 feet of water) and No. 20 (Lake Amatitlan in front of hotel, Jan-

uary 17). None of these specimens showed the tubercles on the cells shown in many illustrations, but according to descriptions and a few figures, these may be absent. One colony appeared to possess eye-spots, one in each cell. One colony examined measured 60μ diameter, cells 15μ. Full grown colonies are said to attain a diameter of 40–100μ, and individual cells as much as 25μ.

2. **Eudorina stagnale** Wolle.

Eudorina stagnale Wolle, F. W. Alg, U. S., 160, pl. CLII, figs. 11–21, 1887.

This is one of the common elements of the plankton. It occurred in the greater number of samples, never in great abundance, but usually several and often numerous examples could be seen in the field of the microscope at the same time. It was quite frequently found in stages of active division.

There is probably little if any difference between this and the European form *elegans*. Schmidle, in a recent article on Algæ from Brazil (Hedwigia, Vol. 40, 46), identifies the Eudorina found there as *elegans*.

Order DINOFLĀGELLATA.

3. **Peridinium tabulatum** (Ehrenberg).

Glenodinium tabulatum Ehrenberg, Inf. 257, Taf. XXII, fig. XXIII, 1838.

Peridinium tabulatum, Kent, Man. Inf., I, 448, III, pl. XXV, figs. 1–5 and 55–57, 1880–1882; Griffith and Henf., Mic. Dict., 1883; Apstein, Süssw-p., 152, fig. 52, 1896.

Common or abundant in most of the plankton. The form at hand is that with the cleft anterior portion; diameter of a specimen measured, 63μ. Griffith and Henfrey give the length as 1–480″ which reduces to 52μ.

All our examples appear to be of nearly uniform size. They are exceedingly abundant in sample 8, collected at the west end of Lake Amatitlan on the surface. This catch consisted mostly of insect exuviæ and it is worthy of remark that the greater number of the Peridiniums were crowded densely in the cast-off skins as if they had worked their way in for food or shelter.

4. **Ceratium hirundinella** (O. F. Müller).

Bursaria hirundinella O. F. Müller, Vermium terrest., I, 63, 1773.

Ceratium longicorne (Perty) Kent. Man. Inf., I, 457, III, pl. XXV, fig. 26, 1880–1881.

"*Ceratium macroceras* Shrank" Ref. not found.

Ceratium hirundinella, Apstein. Süssw-p., 149, figs. 48–50, 1896.

Rather common, scattered through most of the phytoplankton from Lake Amatitlan, and also in the Atitlan material. Our specimens agree

very well with the figures in Kent, and those in the Riverside Natural History. All are robust and quite rough.

This species is almost cosmopolitan, having been reported from England, India (Kent), the Great Lakes (Riverside Nat. Hist.), and from lakes in Iceland. (I have so far found none in material examined from Lake McDonald, Alaska, though there are several other species represented.) Apstein (l. c.), notes slender 3-horned specimens as occurring in the Dorbersdorf Lakes. All the examples seen from Lake Atitlan are 4-horned but many, perhaps the majority, from Lake Amatitlan, are 3-horned. They do not appear to be more slender than the others however. Kent gives the sizes as "length 1–120″ to 1–90″ 208μ–277μ." The examples at hand measure 220μ long and 70μ wide at the broadest portion of the body.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

BIRD MIGRATION IN THE DISTRICT OF COLUMBIA.

BY WELLS W. COOKE,

Bureau of Biological Survey.

The data on bird migration in the District contained in the records of the Bureau of Biological Survey extend over a long series of years. Before the Biological Survey was organized Coues, Prentiss and Drexler collected assiduously during the years 1858–1861 and have left notes on many hundred specimens. Not many records accumulated during the next fifteen years, but from the late seventies to the present time observations have been almost continuous. On the organization of the Biological Survey, very full notes were obtained for the six years 1886–1891 and, with the aid of the local Audubon Society, for the past six years. The region covered by the District of Columbia is nominally the country within a radius of ten miles of the Capitol, but this limit has been exceeded to include a few notes from contiguous territory.

It will be noticed that the records on fall migration are much less full than for spring. Some common birds have surprisingly few fall dates, *e. g.* Marsh Wren, Blue-gray Gnatcatcher, Yellow Warbler, Kentucky Warbler, Hooded Warbler, Warbling Vireo, Rough-winged Swallow, Cliff Swallow and Baltimore Oriole. Any one having notes on the date of fall departure of any of the above species, will confer a favor by sending them to the Biological Survey.

The three tables that follow contain the names of 293 species—all at present known to have occurred in the District. This is one more species than is contained in the 1902 list of District birds; the additional species is the Lawrence Warbler obtained by Mr. Osgood, May 12, 1907.

Species.	Spring Migration.						Fall Migration.					
	No. of years' record.	Average date of spring arrival.	Earliest date of spring arrival.	No. of years' record.	Average date of the last one seen.	Latest date of the last one seen.	No. of years' record.	Average date of fall arrival.	Earliest date of fall arrival.	No. of years' record.	Average date of the last one seen.	Latest date of the last one seen.
Hermit Thrush	7	April 6	Rare, winter	11	April 29	May 17, '02	10	Oct. 17	Sept. 18, '00	4	Nov. 12	. . . . .
Olive-backed Thrush	20	May 6	April 19, '96	11	May 22	June 2, '07	11	Sept. 16	Sept. 2, '88	6	Oct. 9	Nov. 1, '86
Gray-cheeked Thrush	10	May 10	May 8, '07	9	May 27	May 31, '97	9	Sept. 25	Sept. 15, '97	4	Oct. 7	Oct. 20, '04
Wilson Thrush	16	May 1	April 26, '96	6	May 18	June 2, '07	3	Aug. 23	Aug. 18, '89	4	Sept. 4	Sept. 25, '84
Wood Thrush	24	April 27	April 19, '91	. .	. . . . .	Breeds	. .	. . . . .	. . . . .	6	Oct. 6	Oct. 10, '58
Blue-gray Gnatcatcher	22	April 11	Mar. 30, '07	. .	. . . . .	"	. .	. . . . .	. . . . .	. .	. . . . .	Nov. 23, '90
Ruby-crowned Kinglet	14	April 12	Rare, winter	12	May 6	May 15, '85	10	Oct. 1	Sept. 25, '87	6	Oct. 22	. . . . .
Golden-crowned Kinglet	. .	. . . . .	Winters	11	April 13	April 27, '88	9	Oct. 6	Sept. 30, '94	. .	. . . . .	. . . . .
Red-breasted Nuthatch	. .	. . . . .	"	5	May 1	May 12, '89	7	Sept. 24	Aug. 22, '03	. .	. . . . .	. . . . .
Brown Creeper	. .	. . . . .	"	8	April 27	May 1, '07	6	Sept. 29	Sept. 22, '58	. .	. . . . .	. . . . .
Long-billed Marsh Wren	11	May 1	April 15, '96	. .	. . . . .	Breeds	. .	. . . . .	. . . . .	. .	. . . . .	Nov. 1, '86
Winter Wren	. .	. . . . .	Winters	6	April 26	May 1, '82	10	Oct. 5	Aug. 10, '76	. .	. . . . .	. . . . .
House Wren	20	April 21	April 13, '04	. .	. . . . .	Breeds	. .	. . . . .	. . . . .	6	Oct. 8	Oct. 17, '61
Brown Thrasher	19	April 8	Mar. 22, '08	. .	. . . . .	"	. .	. . . . .	. . . . .	4	Sept. 22	Nov. 13, '87
Catbird	21	April 26	Mar. 19, '05	. .	. . . . .	"	. .	. . . . .	. . . . .	5	Oct. 11	Dec. 31, '83
American Pipit	8	Mar. 21	Feb. 16, '08	. .	. . . . .	May 12, '62	3	Oct. 10	Oct. 2, '07	3	Oct. 31	Nov. 30, '90
Black and White Warbler	24	April 17	April 8, '88	. .	. . . . .	Breeds	. .	. . . . .	. . . . .	6	Sept. 15	Oct. 18, '90
Worm-eating Warbler	15	May 2	April 28, '07	. .	. . . . .	"	. .	. . . . .	. . . . .	6	Sept. 3	Sept. 13, '79
Blue-winged Warbler	8	May 6	April 26, '91	4	May 22	Rare, sum'r	. .	. . . . .	Aug. 13, '89	3	Aug. 29	Sept. 2, '87
Golden-winged Warbler	10	May 4	May 1, '05	7	May 15	" "	. .	. . . . .	Aug. 8, '89	. .	. . . . .	Aug. 21, '87
Nashville Warbler	10	May 3	April 29, '85	6	May 15	May 19, '87	3	Sept. 13	Sept. 5, '82	. .	. . . . .	Oct. 2, '97

Parula Warbler	20	April 26	April 19, '91			Breeds				10	Oct. 4	Oct. 16, '99
Cape May Warbler	9	May 7	May 1, '93	4	May 16	May 20, '82	3	Aug. 28	Aug. 4, '92	6	Oct. 12	Oct. 17, '99
Yellow Warbler	20	April 22	April 4, '62			Breeds						Sept. 28, '90
Black-throated Blue Warbler	22	May 2	April 19, '96	11	May 19	May 30, '88	3	Aug. 27	Aug. 4, '92	6	Oct. 13	Oct. 19, '88
Myrtle Warbler	6	April 2	Rare, winter	14	May 12	May 23, '03	15	Oct. 7	Aug. 7, '59	5	Nov. 28	
Magnolia Warbler	18	May 6	April 22, '91	9	May 25	May 30, '91	7	Aug. 24	Aug. 15, '86	9	Sept. 29	Oct. 6, '94
Chestnut-sided Warbler	18	May 4	April 19, '02	7	May 24	May 30, '91	7	Aug. 17	Aug. 10, '94	5	Oct. 4	Oct. 14, '06
Bay-breasted Warbler	13	May 11	May 2, '96	8	May 20	May 27, '88	5	Sept. 8	Aug. 29, '87	7	Oct. 4	Nov. 6, '87
Black-poll Warbler	23	May 6	April 28, '60	18	June 1	June 16, '07	13	Sept. 24	Aug. 31, '96	12	Oct. 11	Oct. 20, '94
Blackburnian Warbler	16	May 5	April 30, '05	9	May 21	June 3, '07	9	Aug. 26	Aug. 14, '86	6	Sept. 23	Oct. 7, '89
Black-throated Green Warbler	15	April 28	April 22, '05	9	May 16	May 30, '07	7	Sept. 3	Aug. 26, '89	9	Oct. 7	Oct. 21, '88
Pine Warbler	6	April 3	Mar. 20, '05			Breeds				4	Oct. 9	Oct. 29, '82
Yellow Palm Warbler	16	April 9	Mar. 31, '89	14	April 26	May 1, '92	6	Sept. 20	Sept. 4, '87	6	Oct. 16	Oct. 28, '06
Prairie Warbler	20	April 24	April 12, '83			Breeds				5	Sept. 14	Sept. 20, '84
Ovenbird	16	April 23	April 10, '04			"				9	Sept. 28	Oct. 17, '90
Water-Thrush	15	April 28	April 22, '94	9	May 25	June 2, '07	8	Aug. 6	July 21, '94	7	Sept. 21	Oct. 6, '07
Louisiana Water-Thrush	7	April 9	April 2, '05			Breeds				2	Sept. 10	Sept. 12, '95
Kentucky Warbler	9	May 4	April 29, '06			"						Sept. 2, '06
Connecticut Warbler	2	May 24	May 24, '91			May 30, '82	11	Sept. 23	Aug. 28, '86	6	Oct. 13	Oct. 24, '89
Mourning Warbler	10	May 20	May 6, '96	5	May 26	May 30, '07	3	Aug. 19	Aug. 17, '94			Oct. 1, '94
Maryland Yellow-throat	27	April 24	April 13, '91			Breeds				6	Oct. 11	Oct. 21, '95
Chat	23	April 30	April 16, '76			"				4	Sept. 13	Sept. 28, '06
Hooded Warbler	10	April 30	April 19, '96			"						Oct. 1, '99
Wilson Warbler	20	May 10	May 1, '76	7	May 23	May 26, '07	4	Sept. 3	Aug. 27, '87			Oct. 6, '04
Canadian Warbler	18	May 9	May 5, '05	12	May 21	June 2, '07	7	Aug. 16	July 31, '87	9	Sept. 8	Sept. 24, '89
Redstart	23	April 24	April 15, '77			Breeds				13	Sept. 19	Sept. 30, '06
White-eyed Vireo	22	April 23	April 18, '96			"				4	Oct. 8	Oct. 19, '90
Solitary Vireo	11	April 18	April 6, '05	9	May 9	May 18, '96	5	Oct. 10	Sept. 6, '03	6	Oct. 18	Nov. 3, '06
Yellow-throated Vireo	18	April 26	April 19, '91			Breeds				5	Sept. 12	Sept. 29, '07
Warbling Vireo	13	April 30	April 21, '95			"				3	Aug. 22	Sept. 12, '03

Species.	Spring Migration.						Fall Migration.					
	No. of years' record.	Average date of spring record.	Earliest date of spring arrival.	No. of years' record.	Average date of the last one seen.	Latest date of the last one seen.	No. of years' record.	Average date of fall arrival.	Earliest date of fall arrival.	No. of years' record.	Average date of the last one seen.	Latest date of the last one seen.
Red-eyed Vireo	19	April 27	April 21, '95	..	.....	"	..	.....	.....	4	Oct. 17	Nov. 11, '88
Rough-winged Swallow	14	April 11	April 2, '05	..	.....	"	..	.....	.....	..	.....	Sept. 3, '94
Bank Swallow	12	April 20	April 13, '04	..	.....	"	..	.....	.....	4	Sept. 14	Sept. 19, '86
Tree Swallow	12	April 7	Mar. 26, '87	9	May 12	May 26, '89	5	Aug. 5	July 8, '89	3	Sept. 10	Oct. 14, '94
Barn Swallow	16	April 13	Mar. 30, '90	..	.....	Breeds	..	.....	.....	3	Sept. 6	Sept. 19, '86
Cliff Swallow	5	May 1	April 10, '87	2	May 13	June 7, '77	..	.....	July 6, '89	.	.....	.....
Purple Martin	13	April 1	Mar. 19, '03	..	.....	Breeds	..	.....	.....	4	Aug. 24	Sept. 14, '89
Summer Tanager	12	May 3	April 18, '96	..	.....	"	.	.....	.....	6	Sept. 15	Sept. 19, '06
Scarlet Tanager	15	April 30	April 17, '96	..	.....	"	..	.....	.....	5	Oct. 15	Nov. 13, '96
Indigo Bunting	18	May 1	April 29, '07	..	.....	"	..	.....	.....	6	Oct. 9	Dec. 13, '87
Blue Grosbeak	5	May 5	May 1, '78	..	.....	"	..	.....	.....	5	Sept. 16	Sept. 20, '84
Rose-breasted Grosbeak	16	May 5	May 1, '07	7	May 16	May 30, '07	2	Aug. 30	Aug. 29, '87	5	Sept. 23	Oct. 6, '07
Chewink	17	April 5	Rare, winter	..	.....	.....	..	.....	.....	8	Oct. 21	.....
Fox Sparrow	8	Mar. 13	" "	9	April 6	May 11, '82	8	Oct. 21	Oct. 3, '06	9	Nov. 15	.. ....
Swamp Sparrow	8	April 12	" "	17	May 12	May 19, '59	10	Oct. 7	Sept. 28, '90	6	Oct. 27	.....
Lincoln Sparrow	3	May 6	May 3, '85	7	May 18	May 21, '93	2	Oct. 4	Sept. 30, '94	2	Oct. 19	Oct. 21, '88
Junco	..	.....	.....	10	April 30	May 12, '06	9	Oct. 8	Sept. 26, '03	..	.....	.....
Chipping Sparrow	10	Mar. 19	Mar. 9, '02	..	.....	Breeds	..	.....	.....	7	Nov. 11	Dec. 17, '99
Tree Sparrow	..	.....	Winters	9	Mar. 26	April 1, '00*	7	Nov. 21	Oct. 31, '86	..	.....	.....
White-throated Sparrow	6	Mar. 18	Rare, winter	19	May 15	June 14, '99	14	Oct. 4	Sept. 15, '89†	4	Dec. 16	.....
White-crowned Sparrow	6	May 1	" "	6	May 14	May 17, '86	3	Oct. 14	Oct. 7, '88	3	Nov. 20	.....

Henslow Sparrow	8	April 18	April 10, '89			Breeds				4	Oct. 13	Oct. 21, '92
Yellow-winged Sparrow	12	April 22	April 17, '05†			"				5	Oct. 17	Nov. 20, '99
Savanna Sparrow	7	Mar. 20	Rare, winter	9	May 4	May 11, '85	6	Oct. 13	Sept. 21, '03	5	Oct. 23	
Vesper Sparrow	17	Mar. 25	" "	10	April 5	June 14, '99	2	Aug. 26	Aug. 21, '87	5	Oct. 21	
Purple Finch			Winters	12	May 9	May 26, '07	6	Oct. 21	Sept. 17, '87			
Purple Grackle	11	Feb. 20	Rare, winter							4	Nov. 10	
Rusty Grackle			Winters	10	April 12	April 30, '75	7	Oct. 24	Oct. 13, '89			
Baltimore Oriole	21	May 3	April 29, '82									Aug. 26, '87
Orchard Oriole	17	May 2	April 29, '07							3	Aug. 15	Aug. 22, '87
Red-winged Blackbird	6	Mar. 2	Rare, winter			Breeds						
Cowbird	6	Mar. 20	" "			"				3	Dec. 20	
Bobolink	16	May 3	April 26, '96	7	May 20	May 30, '77	9	Aug. 21	July 23, '04	4	Oct. 8	Nov. 14, '85
Least Flycatcher	16	May 2	April 20, '81	11	May 15	May 20, '04			Aug. 13, '87	5	Sept. 9	Sept. 15, '07
Alder Flycatcher	10	May 15	May 8, '06	9	May 21	May 28, '93	3	Aug. 23	Aug. 16, '86	2	Sept. 15	Sept. 17, '90
Green-crested Flycatcher	22	May 7	May 1, '92			Breeds				5	Sept. 1	Sept. 15, '07
Yellow-bellied Flycatcher	16	May 14	May 9, '02	7	May 26	May 30, '91	6	Aug. 17	July 28, '59	4	Sept. 16	Oct. 6, '81
Wood Pewee	21	May 5	April 29, '00			Breeds				5	Oct. 4	Oct. 12, '06
Phoebe	20	Mar. 13	Feb. 23, '02			"				8	Oct. 17	Dec. 31, '83
Crested Flycatcher	23	April 30	April 20, '96			"				6	Sept. 8	Sept. 29, '07
Kingbird	23	April 29	April 18, '96			"				5	Aug. 20	Sept. 23, '05
Hummingbird	13	May 1	April 23, '91			"				5	Sept. 13	Oct. 18, '95
Chimney Swift	16	April 17	April 6, '05			"				6	Oct. 10	Oct. 27, '06
Nighthawk	11	May 3	April 19, '91			"				4	Oct. 4	Oct. 8, '07
Whippoorwill	17	April 21	April 13, '96§			"				4	Oct. 1	Oct. 13, '89
Flicker	6	Mar. 22	Rare, winter			"				4	Dec. 24	
Yellow-bellied Woodpecker			Winters	11	April 14	May 13, '05	11	Oct. 3	Sept. 13, '03			
Kingfisher	7	Mar. 28	Rare, winter			Breeds				3	Nov. 19	
Black-billed Cuckoo	10	May 7	May 5, '06			"				3	Sept. 21	Oct. 6, '88
Yellow-billed Cuckoo	6	May 5	May 3, '07			"				6	Oct. 7	Oct. 13, '89

* Accidental May 7, 1889. † Accidental February 18, 1900. ‡ Accidental August 9, 1907. § Accidental March 18, 1877.

Species.	Spring Migration.						Fall Migration.					
	No. of years' record.	Average date of spring arrival.	Earliest date of spring arrival.	No. of years' record.	Average date of the last one seen.	Latest date of the last one seen.	No. of years' record.	Average date of fall arrival.	Earliest date of fall arrival.	No. of years' record.	Average date of the last one seen.	Latest date of the last one seen.
Osprey	7	April 5	Mar. 19, '05	..	.....	Breeds.	..	.....	.....	2	Oct. 15	Nov. 30, '07
Mourning Dove	10	Mar. 24	Rare, winter	..	.....	"	..	.....	.....	2	Nov. 6	Nov. 11, '99
Killdeer	7	Mar. 15	Feb. 14, '08	..	.....	"	..	.....	.....	..	.....	Dec. 18, '87
Spotted Sandpiper	16	April 22	April 2, '05	..	.....	"	..	.....	.....	2	Sept. 29	Oct. 28, '06
Bartramian Sandpiper	5	April 15	Mar. 21, '96	..	.....	April 24, '90	..	.....	June 29, '02	3	Aug. 10	Aug. 23, '89
Solitary Sandpiper	12	April 30	April 25, '00	13	May 16	May 21, '06	3	July 21	July 15, '99	11	Sept. 21	Sept. 30, '99
Yellowlegs	5	May 1	Mar. 12, '06	3	May 8	May 11, '00	3	Aug. 27	Aug. 21, '94	..	.....	Oct. 2, '99
Greater Yellowlegs	2	April 23	April 19, '87	..	.....	May 16, '96	2	July 28	July 24, '90	2	Sept. 28	Sept. 30, '93
Semipalmated Sandpiper	..	.....	.....	..	.....	May 22, '62	3	Aug. 16	Aug. 13, '94	2	Oct. 20	Oct. 26, '87
Least Sandpiper	..	.....	.....	..	.....	May 15, '00	..	.....	Aug. 21, '97	..	.....	Sept. 3, '94
Pectoral Sandpiper	..	.....	.....	..	.....	April 22, '87	4	Sept. 5	Aug. 23, '89	..	.....	Oct. 22, '60
Wilson Snipe	7	Mar. 15	Mar. 9, '94	5	May 2	May 11, '07	3	Sept. 3	Aug. 30, '94	..	.....	Nov. 18, '99
Woodcock	4	Mar. 16	Feb. 20, '59	..	.....	Breeds	..	.....	.....	4	Nov. 14	Nov. 29, '00
Coot	..	.....	.....	..	.....	May 2, '04	9	Sept. 20	Sept. 1, '90	4	Oct. 21	Oct. 31, '99
Sora	..	.....	.....	..	.....	May 5, '00	14	Aug. 13	Aug. 3, '99	5	Oct. 19	Nov. 9, '78
Virginia Rail	..	.....	.....	..	.....	April 6, '92	..	.....	.....	..	.....	Dec. 9, '89
Green Heron	10	April 19	April 9, '05	..	.....	Breeds	..	.....	.....	5	Aug. 27	Sept. 15, '07
Great Blue Heron	5	April 3	Mar. 6, '95	..	.....	June 23, '07	4	Aug. 10	July 14, '07	..	.....	Dec. 5, '94
Canada Goose	..	.....	Winters	..	.....	Mar. 14, '07	13	Oct. 14	Oct. 5, '88	..	.....	.....
Ruddy Duck	..	.....	"	..	.....	June 21, '77	8	Sept. 23	Aug. 20, '89	..	.....	.....
Golden-eye	..	.....	"	..	.....	April 1, '59	10	Oct. 25	Oct. 8, '01	..	.....	.....

Ring-necked Duck		Winters.			Mar. 13, '42	5	Oct. 24	Oct. 6, '01			
Lesser Scaup		"			May 30, '05	10	Oct. 12	Sept. 25, '03			
Greater Scaup		"			Once, nested	4	Oct. 18	Oct. 1, '95			
Canvasback		"			Mar. 25, '81	16	Oct. 21	Oct. 15, '03			
Redhead		"				9	Oct. 10	Oct. 5, '01			
Pintail		"			April 1, '42	6	Oct. 12	Sept. 13, '90			
Blue-winged Teal		"			June 2, '92	10	Aug. 27	Aug. 18, '89			
Green-winged Teal		"			Mar. 11, '52	8	Sept. 30	Sept. 18, '03			
Black Duck		"			Mar 17, '07	6	Sept. 26	Aug. 1, '87			
Mallard		"	4	Mar. 17	Mar. 19, '05	7	Sept. 20	Aug. 28, '96			
Hooded Merganser		"			April 8, '06	7	Oct. 21	Sept. 17, '95			
American Merganser		"			May 26, '05	2	Oct. 19	Oct. 13, '89			
Bonaparte Gull			7	May 1	May 30, '84	2	Oct. 28	Oct. 26, '94			
Herring Gull					May 10, '87	4	Dec. 20	Nov. 25, '94			
Horned Grebe			5	April 17	April 28, '07	3	Aug. 28	Aug. 20, '94			

Permanent Residents.

The following species occur in the District throughout the entire year:

Bluebird.*
Robin.*
Carolina Chickadee.
Tufted Titmouse.
White-breasted Nuthatch.
Carolina Wren.
Mockingbird.* †
Migrant Shrike. †
Cedarbird.*
Cardinal.
Song Sparrow.
Field Sparrow.*
Goldfinch.
English Sparrow.
Red Crossbill.†
Meadowlark.*
Fish Crow.
Crow.
Blue Jay.
Red-bellied Woodpecker.
Red-headed Woodpecker.*
Pileated Woodpecker.
Downy Woodpecker.
Hairy Woodpecker.* †
Great Horned Owl.
Screech Owl.
Barred Owl.
Long-eared Owl.
Barn Owl.
Sparrow Hawk.
Bald Eagle.
Broad-winged Hawk.
Red-shouldered Hawk.
Red-tailed Hawk.
Cooper Hawk.
Sharp-shinned Hawk.
Marsh Hawk. †
Turkey Vulture.
Wild Turkey (formerly).
Ruffed Grouse.
Bob-white.
Night Heron.*
Wood Duck.*

* Rare in winter. † Rare in summer.

Rare or Casual Visitors.

The following list includes the species that have been noted only a few times in the District. Most of them are stragglers but a few occur here regularly in small numbers.

Bicknell Thrush.—October 3, 1885; May 14–18, 1888; May 17, 1892; May 24, 1893.

Northern Chickadee.—December 10, 1859; December 24, 1876; December 25, 1878; January 2–February 2, 1879; common February 21–April 19, 1885; October 19, 1896.

Short-billed Marsh Wren.—May 5, 1890; May 3, 1893.

Bewick Wren.—Has been noted in the spring of ten different years; average date of arrival April 4, earliest March 26, 1897; has remained to July but not known to nest and no females seen; noted twice in fall, November 24, 1889; December 22, 1890.

Prothonotary Warbler.—May 2, 1861; May 17, 1888; May 11, 1894.

Brewster Warbler.—May 15, 1885; May 1, 1895.

Lawrence Warbler.—May 12, 1907.

Orange-crowned Warbler.—October 13, 1889; October 14, 1894.

Tennessee Warbler.—May 6, 1899; May 15, 1904; May 7, 1905; not rare in fall; average date of arrival September 5, earliest August 31, 1890; average date of departure October 4, latest November 30, 1889.

Usnea Warbler.—This is the northern form of the Parula Warbler. It is a common migrant, but its records can not be separated from those of the Parula.

Cerulean Warbler.—May 5, 1888; May 11, 1890; May 12, 1899; May 29, 1902; May 9 and 15, 1904; May 3 and 11, 1907; once reported in the fall.

Yellow-throated Warbler.—The earliest dates are April 19, 1901; April 30, 1905; April 25, 1907; and the latest are September 7, 1881; September 4, 1890; August 20, 1893; breeds rarely near Dyke, Va.

Kirtland Warbler.—September 25, 1887.

Palm Warbler.—Noted in the spring from April 22, 1885, to May 11, 1890, and in the fall from September 18, 1887, to October 11, 1861; probably occurs each year, but is not distinguished from the Yellow Palm Warbler.

Grinnell Water Thrush.—May 11, 1879; May 5, 1885; August 5, 1886.

Northern Yellow-throat.—Abundant migrant, but the records are not separable from those of the Maryland Yellow-throat.

Philadelphia Vireo.—September 20, 1884; May 12, 1902; May 12, 1907.

Northern Shrike.—November 7, 1884; November 6–December 26, 1887; November 17, 1888; October 1, 1891; February 10, 1846; February 2, 1896.

Dickcissel.—Formerly a common breeder; now an accidental visitant. The latest records are: one, May 31, 1887; three, August 4–5, 1890; two, May–July, 1894.

Bachman Sparrow.—April 29, 1896.

Montana Junco.—April 28, 1890.

Lark Sparrow.—August 25–27, 1877; August 8, 1886.

Nelson Sparrow.—September, 1862; September 18, 1893; September 26, 1898; May, 1906.

Lapland Longspur.—Several, December 11, 1886.

Snowflake.—One, November, 1886; a large flock, February 18, 1905.

Pine Finch.—February 25, 1879; March 6, 1885; March 6, 1887; October 24–November 8, 1887; January 22–29, 1888; May 19, 1888; October 24, 1889; common, winter 1896–97; common, May 15–20, 1904; May 10, 1907.

Redpoll Linnet.—One, February 19, 1875; seven, February 12, 1899.

White-winged Crossbill.—One, about 1864; one, about 1874; one, November, 1906; one, August 12, 1907.

Pine Grosbeak.—Several, January 23, 1888.

Bronzed Grackle.—April 17, 1886; April 6, 1887; February 22, 1888; March 8, 1895; March 17–28, 1896; March 4, 1897; February 22, 1898.

Yellow-headed Blackbird.—August 29, 1892.

Horned Lark.—December 5, 1860; December 10-11, 1886; April 2, 1887; November 25, 1888; April 7, 1889; October 29, 1889; March 29, 1891; November 25, 1903.

Prairie Horned Lark.—February 8, 1881; January 13–February 16, 1888; August 11, 1889.

Olive-sided Flycatcher.—One, September, 1881; one, May, 1887; one other specimen, without date.

Arkansas Kingbird.—September 30, 1874.

Scissor-tailed Flycatcher.—Once.

Chuck-will's-widow.—July 22, 1895; once, summer 1896.

Snowy Owl.—One, about 1859; one, November, 1885; one, December 30, 1890; about fifteen taken the winter of 1876–77.

Saw-whet Owl.—February 12, 1859; November 1, 1878; December, 1880; October, 1886; December, 1889; December 12, 1890; January 4 and 29, 1891; February 19, 1893.

Short-eared Owl.—April 12, 1859; April 20, 1861; March, 1862; November 13, 1887.

Pigeon Hawk.—September 7, 1878; September 25, 1879; October 13, 1884; October 13, 1889; September 4, 1890; November 10, 1891; April 13, 1898; April 22, 1900.

Duck Hawk.—December, 1878; October 23, 1900; one has been seen several times in winter about the Post Office building.

Golden Eagle.—December 26, 1857; March 7, 1859; December 8 and 16, 1887; November 24, 1890.

Rough-legged Hawk.—One, 1859; December 29, 1879; one, winter 1880; December 3, 1882; two, March, 1888.

Goshawk.—One, before 1883; December 27, 1887; January 1, 1896.

Swallow-tailed Kite.—August 7, 1879; August 3, 1895; April 11, 1897.

Black Vulture.—Four, March 30, 1895; one July, 1896; one December 17, 1899.

Ground Dove.—September, 1844; October 14, 1888.

Passenger Pigeon.—Formerly abundant, now extinct; the latest dates are: September 18, 1877; April 3 and 4, 1887; September 11 and October 19, 1889.

Turnstone.—Three, about 1860; two, May, 1881.

Piping Plover.—March 25, 1881; May 3, 1884.

Semipalmated Plover.—August 26, 1877; May 9, 1879; May 3, 1884; August 22, 1892; August 30–September 22, 1894; August 21, 1897; May 16–25, 1906; May 10, 1907.

Golden Plover.—Once taken nearly fifty years ago.

Long-billed Curlew.—Once taken on the Potomac River.

Ruff.—September 3, 1894.

Willet.—A flock, August 10–11, 1893; other records without dates.

Sanderling.—September, 1874; October 24, 1885; three, September 22, 1894; two, September 26–30, 1898.

Western Sandpiper.—September 8, 11, 14, 22, 1894; August 21–September 3, 1897.

Red-backed Sandpiper.—October 22, 1844; April 22, 1887; September 25, 1894; also on April 24 and November 11—year unrecorded.

Baird Sandpiper.—September 3 and 25, 1894.

Stilt Sandpiper.—September 8, 1885.

Long-billed Dowitcher.—Seven, April, 1884.
Dowitcher.—One, September, 1879.
Northern Phalarope.—August 31, 1891.
Red Phalarope.—October 17, 1885.
Florida Gallinule.—One, 1863; October 15, 1880; August 12–September 7, 1892; September 1, 1893; April 19, 1892.
Black Rail.—One, September, 1861; one, about 1880.
Yellow Rail.—November 17, 1893; October 4, 1879; April 14, 1893.
Clapper Rail.—September 8, 1882.
King Rail.—December 16, 1889; November 7, 1891; December 21, 1892; young, June 26, 1893.
Sandhill Crane.—Once, many years ago.
Yellow-crowned Night Heron.—Once, August, 1901.
Little Blue Heron.—A large flock, August, 1875; July 27, 1878; August 6–13, 1879; August 29, 1880; July 29, 1894; August 2, 1896; July 16, 1904.
Snowy Heron.—Has been reported several times in early fall; some of these records are probably the Little Blue Heron in the white phase.
American Egret.—July 22, about 1858; May 30, 1891; July 8, 29, August 2, 1894; in the early days of the District this species was quite common in August.
Least Bittern.—May 19, 1859; September 19, 1881; August 12, 1892; May 22, 1893; August 14, 1893; August 3, 1899; May 18, 1907; young, August 1, 1894.
American Bittern.—April 30, 1859; November 3–7, 1860; April 8, 1879; April 13, 1883; April 1, 1891; March 22, 1894; August 8, 1894; July 15, 1899.
Glossy Ibis.—One record about 1817; one other record.
Wood Ibis.—July 2, 1892; July 18, 20, 27, 1896.
Whistling Swan.—Average date of arrival in the fall, November 6, earliest October 15, 1901; very rare in spring, March 25, 1881; March 22, 1907.
Brant.—December 16, 1858.
Surf Scoter.—December 11, 1858; February 19 and April 10, 1859.
White-winged Scoter.—November, 1880; October 14, 1882; October 28, 1894; April 18, 1892.
American Scoter.—Once, many years ago.
American Eider.—Once, many years ago.
Old-squaw.—April, 1856; April 15, 1881; April 3, 1889; October 20, 1889; April 20, 1896; one winter record.
Bufflehead.—January 29 and April 10, 1859; April 3, 1876; one other record in November.
Barrow Golden-eye.—Recorded, but doubtful.
Shoveler.—October 28, 1887; September 21, 1894; October 3, 1901.
European Teal.—One, April, 1885.
Baldpate.—Occurs, but no specific dates.
European Widgeon.—October 16, 1892; once in spring.
Gadwall.—One about 1860; a flock, August 24, 1884.

Red-breasted Merganser.—Regular winter resident, but seldom reported; seen, October 23, 1892.

White Pelican.—One, 1863; one, April, 1864; two, fall, 1864; one, October, 1878.

Double-crested Cormorant.—One, 1859; July 19, 1884; November, 1884; two, April 19, 1896; one, October 1, 1896.

Audubon Shearwater.—One record, probably correct.

Leach Petrel.—One, August, 1842; two about 1859; one, June 7, 1891; one, probably this species, January, 1878.

Hawaiian Petrel.—Two, August 29, 1893.

Wilson Petrel.—One about 1859.

Black Skimmer.—September 8, 1858.

Black Tern.—August 17, 1878; September 18, 1882; September 1–18, 1893; August 29–September 22, 1894; August 15–September 3, 1897; August 17, 1898; August 22, 1900.

Least Tern.—One about 1858–9; one August 17, 1878.

Common Tern.—One about 1860; a flock of twelve, May 7, 1894.

Forster Tern.—One, 1876.

Caspian Tern.—September 29, 1896; two, October 4, 1896.

Gull-billed Tern.—Once in the fall.

Laughing Gull.—Two, September 24, 1894; other records without dates.

Ring-billed Gull.—January 23, March 13, April 28, 1887; March 30, April 1, 1890; February 5, 1900.

Brunnich Murre.—Several late December, 1896.

Red-throated Loon.—One, spring, 1882; October 20, 1889; November 15, 1892; October 30, 1904.

Loon.—September, 1877; November 4, 1881; December, 1885; October 25–27, 1887; May 1–2, 1888; October 25, 1894; May 24, 1896; June 2, 1907.

Pied-billed Grebe.—September 6, 1845; April 10, 1879; November 3, 1884; April 24, 1887; August 27, 1890; April 21, 1894; September 21–25, 1894.

Holboell Grebe.—September 30, 1877.

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PROCEEDINGS

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NOTES ON THE WINTER BIRDS OF NORTHERN LOUISIANA.

BY ARTHUR H. HOWELL.

During a recent trip in northern Louisiana in the interests of the Biological Survey, about 200 specimens of birds were collected, and many notes on their distribution and abundance secured.

Upon working over this material several species and subspecies not recorded in the most recent State list* were found, and many apparently new facts with regard to the distribution of species were brought to light. It seems desirable, therefore, to publish a list of all the species observed.

The localities visited are as follows: Clarks, Caldwell Parish, in the heavily timbered portion of the State, January 6–8, 1908; Alexandria, January 9; Lecompte, 15 miles south of Alexandria, January 11–15 and February 10–12; Natchitoches, January 16–22; Mansfield, DeSoto Parish, January 23–25; Shreveport,† January 27–31; Belcher, Bossier Parish, February 3–7.

The following species and subspecies are here recorded for the first time from Louisiana:

Sturnella neglecta.
Agelaius phœniceus arctolegus.
Coturniculus savannarum bimaculatus.
Melospiza lincolni.
Toxostoma rufum longicaudum.
Penthestes carolinensis agilis.
Planesticus migratorius achrusterus.

* See "The Avifauna of Louisiana," by Geo. E. Beyer, Proc. Louisiana Soc. of Naturalists, 1897–1899 (1900), pp. 75–120.

†All the records from Shreveport were made on Mr. Henry Carlton's farm in Bossier Parish about 5 miles east of Shreveport.

The only previous record of the Northern Flicker (*Colaptes a. luteus*) from Louisiana appears to be that given by P. A. Taverner (under the name *Colaptes auratus*) of a tagged Iowa bird shot at Many, Louisiana, December 25, 1905.*

The specimens collected have been identified by H. C. Oberholser of the Biological Survey.

Ardea herodias Linn.
One seen in a swamp at Lecompte, January 11.

Gallinago delicata (Ord).
Two seen at Shreveport, January 28 and 29.

Oxyechus vociferus (Linn.).
A flock of 50 or 60 fed in the fields at Lecompte and a flock of 100 or more in the fields near Shreveport.

Colinus virginianus (Linn.).
Common at Natchitoches, Shreveport, and Belcher; one flock seen at Clarks. Two specimens, Clarks and Shreveport. The quail of this region appear smaller in life than birds from the northeastern States but comparison of specimens reveals no differences of importance.

Zenaidura carolinensis (Linn.).
Scarce. Only two small flocks seen — one at Lecompte and one at Natchitoches.

Cathartes aura septentrionalis Wied.
Common at all localities visited.

Catharista urubu (Vieillot).
Common at Alexandria, Lecompte, and Natchitoches; one seen at Clarks.

Circus hudsonius (Linn.).
One seen at Lecompte, January 13 and 15.

Falco sparverius Linn.
Scarce; seen at Clarks, Lecompte, Natchitoches, and Mansfield.

Syrnium varium alleni Ridgway.
One seen at Lecompte. There is a specimen of this form in the Biological Survey Collection from Eldorado, Louisiana.

Otus asio floridanus (Ridgway).
Scarce; heard at Shreveport and Belcher.

Ceryle alcyon (Linn.).
One seen at Clarks, two at Lecompte.

Dryobates villosus audubonii (Swainson).
Three specimens, Natchitoches, January 17, 20, 21.

Dryobates borealis (Vieillot).
One taken at Clarks.

Sphyrapicus varius (Linn.).
A few observed at each locality visited.

*Auk, XXIII, 1906, p. 232.

Melanerpes erythrocephalus (Linn.).
Rather common at Lecompte; a few at Clarks and Belcher.

Melanerpes carolinus (Linn.).
Numerous at Lecompte; a few at Natchitoches, Mansfield, Shreveport, and Belcher.

Colaptes auratus luteus Bangs.
Occurs in small numbers in all timbered regions; particularly common at Lecompte. Five specimens, four from Lecompte, one from Belcher. Taken also at Mansfield, April 27, 1907.

Sayornis phœbe (Latham).
A few seen at each locality visited.

Cyanocitta cristata (Linn.).
Common at Lecompte and Belcher; rather uncommon at other localities. Three specimens, Belcher.

Corvus brachyrhynchos Brehm.
Common in open farming country; one specimen, Shreveport.

Molothrus ater (Bodd.).
A few noted at nearly all localities visited.

Agelaius phœniceus phœniceus (Linn.).
Common at Natchitoches, Shreveport, and Belcher; 16 specimens from these localities. Observed in small numbers at Lecompte and Mansfield. At this season the males greatly outnumber the females. This was especially true of the large flocks seen at Belcher in February which were composed almost entirely of males.

Agelaius phœniceus arctolegus Oberholser.
Two specimens, Natchitoches, January 20, and Belcher, February 4.

Sturnella magna magna (Linn.).
Common in open country. Seven specimens from the following localities: Clarks, 1; Lecompte, 1; Shreveport, 5.

Sturnella magna argutula Bangs.
Four specimens: Lecompte, 1; Natchitoches, 1; Belcher, 2.

Sturnella neglecta Aud.
One specimen from Lecompte, January 13, and one from Shreveport, January 29. Probably not uncommon in the northwestern part of the State, though no songs were heard and identification in the field was therefore impossible.

Euphagus carolinus (Müll.).
A flock of about 30 seen at Lecompte, January 15. None seen at other localities except a single specimen shot from a flock of *E. cyanocephalus* at Natchitoches.

Euphagus cyanocephalus (Wagler).
Abundant near Shreveport, January 27–31; small flocks seen at Natchitoches and Belcher.

Quiscalus quiscula æneus Ridgway.

Small flocks seen at Clarks, January 5 and 6; a few were observed at Belcher, February 5, flying to roost with other blackbirds.

Carpodacus purpureus (Gmelin).

Scarce; a few seen at Clarks, Lecompte, and Shreveport.

Astragalinus tristis (Linn.).

A few at each locality visited.

Poœcetes gramineus gramineus (Gmelin).

Common at Natchitoches, January 17–21; not seen elsewhere except a few at Mansfield, January 24. Six specimens from above localities.

Passerculus sandwichensis savanna (Wilson).

Common at Lecompte in January; seen in small numbers at Alexandria, Natchitoches, and Shreveport. Fourteen specimens from above localities.

Coturniculus savannarum bimaculatus (Swainson).

One taken at Natchitoches, January 21; the only one seen.

Ammodramus lecontei (Aud.).

One taken at Natchitoches, January 17.

Zonotrichia leucophrys (Forster).

A small flock seen at Natchitoches, January 17, and a few at Shreveport, January 27. One specimen, Natchitoches.

Zonotrichia albicollis (Gmelin).

Common at nearly all localities visited.

Spizella socialis (Wilson).

A few seen at Clarks, January 7, and a few at Mansfield, January 23.

Spizella pusilla pusilla (Wilson).

Abundant at Natchitoches, January 17–21; fairly common at Mansfield; rare at other localities visited. Seven specimens from various localities.

Spizella pusilla arenacea Chadbourne.

Two specimens: Natchitoches, January 17, and Belcher, February 6. Although not included in Mr. Beyer's list, this form had been recorded from Mandeville, Louisiana, by Mr. F. M. Chapman.*

Junco hyemalis (Linn.).

A few observed at Clarks, Lecompte, and Mansfield.

Peucæa æstivalis bachmani (Aud.).

Not observed on the present trip; it was common at Mansfield, however, in late April and early May, 1907.

Melospiza melodia (Wilson).

A few were observed at nearly every locality visited, but they were nowhere common.

Melospiza lincolni (Aud.).

One taken at Mansfield, January 24. This appears to be the first record of its occurrence in the State.

* Auk, VIII, 1891, p. 318.

Melospiza georgiana (Latham).

Fairly common about the cultivated fields at nearly every locality visited.

Passerella iliaca (Merrem).

A few seen at Clarks, Natchitoches, Shreveport, and Belcher.

Pipilo erythrophthalmus (Linn.).

Present in small numbers at nearly all localities.

Cardinalis cardinalis cardinalis (Linn.).

Common at all localities. Thirteen specimens, which show no approach to *C. c. magnirostris* Bangs.

Ampelis cedrorum (Vieillot).

Abundant at Alexandria and Natchitoches. Their principal food at this season is hackberries (*Celtis*), and the birds visit the hackberry groves in immense numbers. They present an easy mark for the amateur gunner, and in some localities thousands are shot daily for food. As I stood under a tree in which a large flock of waxwings was feeding, skinned hackberries were falling to the ground like hail. The birds' mouths, gullets and entire intestinal tracts were filled with *entire* hackberries. Apparently some of the berries are swallowed whole while others are partially skinned.

Lanius ludovicianus migrans Palmer.

Fairly common at all localities visited. Seventeen specimens, from every locality excepting Clarks; all prove to be typical *migrans*.

Lanivireo solitarius (Wilson).

One taken January 11, at Lecompte.

Dendroica coronata (Linn.).

Common at all localities, both in timber and fields. They have a special liking for swamps, feeding in brush close to the water.

Dendroica vigorsi (Aud.).

Observed in small numbers at Clarks, Natchitoches, Mansfield, and Belcher.

Geothlypis trichas brachidactyla (Swainson).

One taken at Lecompte, January 11; another seen there January 14.

Anthus pensilvanicus (Latham).

Observed at all localities visited. Most abundant at Alexandria, Lecompte, and Shreveport, at each of which localities flocks of 200 or more were seen.

Mimus polyglottos (Linn.).

Common at all localities visited; four specimens.

Toxostoma rufum rufum (Linn.).

Two specimens, Clarks and Belcher. Rather common at Lecompte. A few observed also at Natchitoches, Mansfield, and Shreveport.

Toxostoma rufum longicaudum (Baird).*

Five specimens (Lecompte, 4; Belcher, 1) have been identified by Mr. Oberholser as this form.

Thryothorus ludovicianus (Latham).

Fairly common at all localities; 12 specimens.

Thryomanes bewicki (Aud.).

Observed in small numbers at all localities visited excepting Clarks and Lecompte. Seven specimens: Alexandria, 1; Natchitoches, 2; Mansfield, 1; Shreveport, 1; Belcher, 2.

Nannus hyemalis (Vieillot).

Two specimens, Clarks, January 6, and Lecompte, January 14. One seen at Mansfield.

Sitta carolinensis Latham.

A pair taken at Belcher, February 4.

Bæolophus bicolor (Linn.).

Fairly common in all timbered regions; 8 specimens.

Penthestes carolinensis agilis (Sennett).

Fairly common at all localities visited; six specimens from five localities all prove to be of this form.

Regulus calendula (Linn.).

Rather common at all localities visited.

Hylocichla guttata pallasi (Cabanis).

Common in all timbered regions; fifteen specimens, from all localities visited except Alexandria.

Planesticus migratorius (Linn.).

Present at all localities visited; very abundant at Natchitoches, January 17 and 18. They are attracted by groves of hackberry trees, the fruit of which furnishes their principal food at this season. They become very fat and are much prized for food, many thousands being shot by the local hunters.

The habit of roosting at night in the canebrakes also leads to their destruction, for they are often sought out by men and boys with lanterns, who knock down and kill hundreds of the birds with clubs. Three specimens: Alexandria, Lecompte, and Natchitoches.

Planesticus migratorius achrusterus (Batchelder).

Six of the seven Robins taken at Natchitoches prove to be of this form.

Sialia sialis (Linn.).

Observed in small numbers at nearly all localities.

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* *H* [*arporhynchus*] *longicauda* Baird, Rep. Pacific R. R. Surveys, IX, 1858, p. 353.

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PROCEEDINGS

OF THE

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NEW GENERA OF UNSTALKED CRINOIDS.

BY AUSTIN HOBART CLARK,

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Some time ago I published a revision of the genus "*Antedon*" as understood by Dr. P. H. Carpenter and most modern workers upon the *Crinoidea*, in which I divided the group into eighteen genera in an attempt to better bring out the relationship of the various specific types. The material at hand at the time was not very extensive, and I was forced to leave certain genera, most especially *Antedon* (as restricted), in a somewhat unsatisfactory condition; although I realized that I was "lumping" certain well-defined generic types under a single generic name, I did not feel justified in making any further subdivisions. Further study and more abundant material have shed much light upon many obscure points, and I am now able to point out certain additional, apparently well-marked and homogeneous, specific groups.

My previous paper contains one or two errors, which I take this opportunity of correcting; the pinnules of *Calometra* are said to be cylindrical, whereas in reality they are sharply triangular; this error arose from having studied only wet material, whereas a true idea of the characters of the Comatulida can only be ascertained from dried specimens; I followed Carpenter in placing *Antedon dübeni* of Böhlsche near *Antedon bifida*, in my restricted genus *Antedon*; it is, however, merely the young of *Tropiometra carinata*; *Antedon tenuicirra* of Carpenter should have been placed in *Thysanometra*; it is possibly the young of *T. tenelloides*, but further material is necessary before they can be united with certainty; the species *compressa* and *orion*, placed

* Published by permission of the Commissioner of Fish and Fisheries.

in *Charitometra*, should have been referred to *Thalassometra ;* the *Antedon flava* of Kœhler and the *Antedon porrecta* of Carpenter (which were omitted) also belong to *Thalassometra.* I had not been able to consult Professor Bell's paper on South African crinoids, although I had examined specimens of his *capensis ;* of the two other species described, *sclateri* belongs to the genus *Charitometra* (near *C. inæqualis*) and *magnicirra* to *Thalassometra.*

FAMILY HIMEROMETRIDÆ.

Oligometra gen. nov.

Genotype.—*Antedon serripinna* P. H. Carpenter, 1881.

Centro-dorsal flat, discoidal, the cirri marginal, in one or two more or less irregular and crowded rows. Cirri short and stout, composed of few, twenty or less (rarely one or two more), squarish or short joints; the opposing spine central in position and short; the distal joints may bear centrally situated spines, paired spines, or tubercles. Radials more or less concealed; costals rounded, broad, and may or may not be in apposition laterally. Ten arms of rather short, wedge-shaped joints, becoming oblong distally. Proximal pinnules rather stouter and stiffer than the others, but not especially marked; one or more elongate, but little, if any, longer than the distal pinnules; the proximal joints of the lower pinnules often bear strong, thin, rounded keels, or elongate processes, and the distal joints may have overlapping and spiny distal ends.

Color.—Purple or yellow, or yellow or white, more or less heavily banded or mottled with purple.

Geographic distribution.—Tropical; Caribbean Sea at Panama; east Africa eastward to northern Australia and southern Japan.

Depth.—Littoral, but occurring down to 60 fathoms.

The short, stout cirri, with short or squarish subequal joints bearing dorsal spines or tubercles, and the opposing spine in the center, and the round and stiffened, but otherwise not specially differentiated, lower pinnules distinguish this genus at a glance. The included species are,

O. adeonæ (Lamarck).
O. bidens (Bell).
O. caribbea A. H. Clark.
O. japonica (Hartlaub).
O. pinniformis (P. H. Carpenter).
O. serripinna (P. H. Carpenter).
O. carpenteri (Bell).

FAMILY ANTEDONIDÆ.

Erythrometra gen. nov.

Genotype.—*Antedon ruber* A. H. Clark, 1907.

Radial faces low, about as broad as high; the dorsal surface of the radials is approximally vertical to the dorso-ventral axis of the animal; muscular fossæ small, their area scarcely greater than that of the interarticular ligament fossæ, the notch separating them broad, but comparatively shallow, not reaching half way to the axial canal. Centro-dorsal

hemispherical, the cirrus sockets irregular in distribution, but approaching fifteen columns of two each. Cirri with about thirty joints, a few of the proximal longer than broad, the remainder squarish, the distal not bearing dorsal spines; the opposing spine is prominent, terminally situated, reaching in length rather more than half the diameter of the penultimate joint; the spine is almost an isosceles triangle, arising from the entire dorsal surface of the joint; terminal claw rather stout, well curved, rather longer than the penultimate joint. Interradial areas with two or three columns of small, rounded interradial plates, not in contact; interbrachial plates may or may not be present between the two arms of each pair; disk naked. Costals rather narrow, well separated, the first oblong, about twice as broad as long, the second pentagonal, both occasionally furnished with small dentate processes. Ten arms of comparatively elongate joints. First pinnule longer and stiffer than those following, but shorter than the distal; the pinnule of the fourth (epizygal) brachial is absent.

Color.—Salmon red, the pinnules the same, or yellow; cirri white.

Geographic distribution.—Only known from southern Japan, from the Korean Straits to Sagami Bay.

Depth.—50 to 100 fathoms.

The presence of interradial and interbrachial plates on an otherwise naked disk, distinguish this genus at once from all other genera of Antedonidæ; the absence of the first inner pinnule should be noticed. The only species at present known is,

Erythrometra ruber (A. H. Clark).

Thaumatometra gen. nov.

Genotype.—Antedon ciliata A. H. Clark, 1907 (= *Antedon tenuis* A. H. Clark, 1907).

Radial facets about as broad as high, the muscular fossæ large and well rounded, distally separated by a narrow, sharp notch, which extends for less than one-quarter of the length of their apposed sides; interarticular fossæ remarkably small, the ridge separating them from the muscular fossæ horizontal in its outer half, gently oblique in its inner. Centro-dorsal conical or sub-conical, the sides convex, somewhat thickly, and almost entirely, covered with crowded cirrus sockets. Cirri slender, numerous, with fifteen to thirty subequal joints, all of which are usually longer than broad; there may be a slight ventral overlap, but spines are not developed; the opposing spine is prominent, terminally situated, and directly obliquely forward. Radials almost, or entirely, hidden by the centro-dorsal; costals moderately short, the costal-axillary pentagonal, more or less produced posteriorly. Ten arms, the lowest brachials oblong, broader than long, then triangular about as long as, or rather longer than, broad, distally becoming much elongate, quadrate, or almost oblong, with swollen articulations. The calyx and brachials are often more or less spinous. The first pinnule is slender, composed of elongated joints, and may be somewhat, or not at all, longer than the second; the second

pinnule and those following are stouter than the first, and bear long fusiform genital glands.

Color.—Yellow or brownish yellow.

Geographic distribution.—Antarctic Seas, and Pacific Ocean north to Panama, northern Japan, the Sea of Japan, and the Gulf of Tartary.

Depth.—140 to 1,600 fathoms.

The elongate joints of the first pinnule, and the occurrence of a genital gland on the second and of an oblique opposing spine on the penultimate joint of the cirri distinguish this genus at once from all others. The species are almost all small, reaching the maximum size, in common with *Psathyrometra* and *Heliometra*, in the northern part of the Sea of Japan. The species referable to this genus are,

T. abyssorum (P. H. Carpenter).
T. alternata (P. H. Carpenter).
T. comaster (A. H. Clark).
T. exigua (P. H. Carpenter).
T. hirsuta (P. H. Carpenter).
T. isis (A. H. Clark).
T. laevis (P. H. Carpenter).
T. longipinna (P. H. Carpenter).
T. parra A. H. Clark.
T. parvula (Hartlaub).
T. remota (P. H. Carpenter).

Coccometra gen. nov.

Genotype.—Comatula hagenii Pourtalès, 1869.

Radial facets with long, narrow, triangular muscular fossæ, separated from the interarticular ligament fossæ by a strongly diagonal ridge; the radial face is considerably longer than broad, and almost wedge-shaped in outline. Centro-dorsal low-hemispherical, a rather large area at the pole bare and papillose. Thirty to fifty cirri with fifteen to twenty joints, proximally two or three times as long as broad, gradually becoming shorter distally, the terminal few not being greatly longer than broad; no dorsal spines; opposing spine obsolete. Radials not projecting beyond the centro-dorsal; first costals very short, almost hidden in the median line by a posterior extension of the costal axillaries; there is a strong constriction at the intercostal articulation; costal axillaries longer than wide, the anterior angle produced, and all the sides incurved. Ten arms of moderately elongate joints. Lower pinnules long, approximately equal in length, the first composed of very numerous short joints, very delicate and flexible, the second and following with about half as many joints, the proximal three short, the remainder becoming rapidly elongated; the second and following pinnules bear large genital glands. After the second and third the pinnules gradually decrease in length, then become more slender and increase again, but do not reach the length of the first four.

Color.—Pale greenish, turning white in alcohol; or yellow, with a median stripe of black, or with large round spots of black at the syzygia.

Geographic distribution.—Caribbean Sea, north to Florida.

Depth.—82 to 242 fathoms (Carpenter).

From the genus *Thysanometra*, which also has the first pinnule composed of numerous short joints, and the second and following of elongated joints, *Coccometra* may be most readily differentiated by the character of

the radial faces. In *Thysanometra* these are approximately oblong, broader than long, the muscular fossæ large, transversely rounded-oblong, separated from the interarticular ligament fossæ by horizontal ridges, the exterior ends of which are more or less curved downward. In *Coccometra*, as described, these are wedge-shaped, elongate, the muscular fossæ elongate triangular, separated from the interarticular ligament fossæ by strongly diagonal and straight ridges. Externally, *Coccometra* may be distinguished by its longer arm joints, longer pinnule joints, and short distal pinnules which are not so long as the proximal, while in *Thysanometra* they are considerably longer. This is the only comatulid genus in which the coloration appears to have a systematic value. It includes three species, one which was described by Pourtalès, another mentioned by Dr. Hubert Lyman Clark, and a third as yet undescribed. They are,

C. hagenii (Pourtalès).

C. nigrolineata [=*Antedon hagenii* H. L. Clark (not *Comatula hagenii* Pourtalès), 1901].

Leptometra gen. nov.

Genotype.—Alecto phalangium J. Müller, 1841.

Radial faces wedge-shaped, very long, nearly, or quite, twice as long as broad, the muscular fossæ much elongated, and sub-triangular, separated by a diagonal ridge from the fossæ lodging the interarticular ligaments, and in close opposition interiorly. Centro-dorsal hemispherical, conical, or somewhat columnar, bearing from twenty to thirty cirrus sockets which may, or may not, be regularly arranged, but are always separated more or less from each other. Cirri very long and slender, of more than forty cylindrical joints, slightly more elongate proximally than distally, squarish, or longer than broad; no dorsal spines; usually no opposing spine. Radials more or less hidden; first costal short, second usually pentagonal, rather large, deeply incising the first; the costals are strongly convex dorsally, and may or may not be in lateral apposition and laterally flattened. Ten long and slender arms of obliquely quadrate or triangular joints, as long as or longer than wide. First two pinnules elongate, slender and flagellate, the first six or eight joints short, the remainder elongate; following pinnules shorter, but the length of the basal joints gradually increases, except the two first, which become somewhat flattened; ovaries long and fusiform.

Color.—Green.

Geographic distribution.—Mediterranean Sea, west of Italy and Tunis; eastern Atlantic, from the Madeira Islands northward along the coasts of Europe, and west coast of the British Isles to the Hebrides.*

Depth.—45 to 189 fathoms.

The great length of the muscular fossæ in this genus which are not interiorly separated by a notch is sufficient to distinguish it at once. Externally the elongate and slender cirri, which are smooth with very numerous

*Reported also from Hope, or Seahorse, Island, just southeast of Spitzbergen; but Grieg has already called attention to the fact that this is probably a case of misidentification.

joints, and the equality of the two proximal pinnules readily differentiate it. It appears to be possible to distinguish two species, which are,

L. celtica (Barrett and McAndrew). *L. phalangium* (J. Müller).

Hathrometra gen. nov.

Genotype.—*Alecto dentata* Say, 1825.

Radial faces wedge-shaped, less than once and one-half as long as broad; muscular fossæ triangular, less than twice as long as broad, not separated by a notch; the ridge between the muscular and interarticular ligament fossæ is strongly oblique. Centro-dorsal conical, the sides somewhat convex, thickly covered with small and numerous cirrus sockets, which are closely crowded together, and arranged in more or less definite vertical rows. Cirri slender, with fifteen to forty-five joints, dimorphic, the apical cirri having fewer joints than the peripheral, and being considerably smaller; the proximal cirrus joints are much longer than the distal, and more or less "dice-box shaped"; the distal are squarish, or rather longer than broad, and the dorsal ends may overlap so as to produce spines; an opposing spine is always present, terminally situated. Radials almost, or quite, concealed; costal axillaries rhombic, almost concealing the first costals, which are short, in the median line; the costals are rounded dorsally, and in lateral opposition, though not laterally flattened. Ten arms, with triangular joints proximally, becoming more quadrate distally, always (except in the first few discoidal joints) as long as, or longer than, wide. First pinnule long and slender, twice or three times as long as the second; the following pinnules gradually increase in length; the genital glands are long and fusiform.

Color.—Dark green, or grayish green, sometimes dotted with white.

Geographic distribution.—Coasts of New Jersey and Portugal northward to the Arctic Ocean, and from the seas west of Greenland eastward to the Barents and Kara Seas.

Depth.—25 or less to more than 600 fathoms.

The characteristic conical centro-dorsal with its numerous crowded cirrus sockets, the great length of the first pinnule and the absence of a notch between the distal ends of the muscular fossæ, these being much broader than in *Leptometra*, at once distinguish this genus. *Hathrometra* contains the following species:

H. dentata (Say). *H. sarsii* (Düben and Koren).
H. prolixa (Sladen). *H. tenella* (Retzius).

Iridometra gen. nov.

Genotype.—*Antedon adrestine* A. H. Clark, 1907.

Cirri few and short, with ten to sixteen joints, the proximal elongate, the distal shorter, on a discoidal or low-hemispherical centro-dorsal. Ten arms, the joints triangular, about as long as wide, becoming elongate distally. First pinnule short, never exceeding, and usually shorter than, the second, which does not bear a genital gland.

Color.—Varied and bright, and usually mottled or banded; brick red, white with purple bands, yellow-brown banded with darker, purple and white, or pinkish.

Geographic distribution.—Tonga Islands and northern Australia to Japan and the Hawaiian Islands.

Depth.—Mainly littoral, but extending downward to 150 fathoms.

The short and weak cirri with comparatively few joints, and the small first pinnule are sufficient to differentiate this genus at once. The included species are,

I. adrestine (A. H. Clark). *I. minuta* (A. H. Clark).
I. briseis (A. H. Clark). *I. nana* (Hartlaub).
I. crispa A. H. Clark. *I. parvicirra* (P. H. Carpenter).
I. psyche (A. H. Clark).

Compsometra gen. nov.

Genotype.—*Antedon loreni* Bell, 1882 (= *Antedon pumila* Bell, 1884).

Similar to *Iridometra*, but the first pinnule is much longer than, usually about twice as long as, the second and following, and the joints of the proximal pinnules all overlap strongly.

Color (in spirits).—Olive gray or brownish, sometimes banded narrowly with darker.

Geographic distribution.—Port Jackson, New South Wales, northward to Tokyo Bay, Japan.

Depth.—Littoral, and down to 12 fathoms.

The extraordinary projection of the distal edges of the pinnule joints and the small cirri with comparatively few joints, which are distally much compressed and comparatively broad, distinguish this species at once. The two species at present know are,

C. loreni (Bell). *C. serrata* (A. H. Clark).

Trichometra gen. nov.

Genotype.—*Antedon aspera* A. H. Clark, 1908.

Radial faces low, wedge-shaped, or almost triangular, the muscular fossæ practically equilateral right-angle triangles, the distal apices separated by a small, narrow, and acute notch; ridges separating the muscular and interarticular ligament fossæ horizontal. Centro-dorsal subconical, with somewhat strongly convex sides, thickly covered with small cirrus sockets, somewhat crowded, roughly arranged in two or three columns in each radial area. Forty to sixty cirri with twenty-five to thirty-five joints, elongate in the proximal half of the cirrus, squarish in the distal, the joints in the latter having a sharply carinate dorsal surface which projects more or less distally, giving a slightly spinous appearance; the opposing spine is prominent, terminally situated, arising from the entire dorsal surface of the joint, but does not reach the diameter of the joint in length; the terminal claw is rather longer than the penultimate joint, moderately stout, but comparatively slightly curved. "Small mature" cirri occur about the dorsal pole, which are sometimes less than half the length of the other cirri, consisting of ten or twelve very slender and much elongated joints, with greatly expanded articulations. Distal edges of radials even with the edge of the centro-dorsal, not extending up into the angles of the centro-dorsal; first costals very short, sometimes

six or eight times as broad as long; costal axillaries rhombic, as broad as or broader than long; the costals are in close apposition, and may be laterally flattened. Ten arms, the joints (except the proximal, which are transversely oblong or squarish), triangular or obliquely quadrate, about as long as wide, becoming more elongate distally. The first pinnule is exceedingly slender, half again as long to three times as long as the stouter second pinnule, composed of much elongated joints, especially distally where they are slender and threadlike, with the distal ends much expanded.

Color.—Yellow.

Geographic distribution.—Bahama Islands to Savannah, Georgia; Hawaiian Islands, about Molokai and the southern part of Oahu, and off Maui.

Depth.—270 to 440 fathoms.

The peculiar, long and slender first pinnule and the short costals, together with the numerous cirrus joints which are short distally, the short opposing and long terminal spine, the latter but little curved, at once distinguish this genus. The only known species are,

T. aspera (A. H. Clark). *T. rexator* (A. H. Clark).

Bathymetra gen. nov.

Genotype.—Antedon abyssicola P. H. Carpenter, 1888.

Centro-dorsal small, hemispherical, the cirrus sockets rather small and well separated, arranged more or less regularly in fifteen columns, one to three to a column. Fifteen to forty-five cirri with eight to fifteen joints; first joint short, second longer than broad, usually considerably elongated, the following joints gradually decreasing in length distally; all the joints have enlarged and flaring distal ends; there are no dorsal spines, but the opposing spine is always well developed, triangular, its distal edge vertical, its proximal edge straight, running from the anterior end of the penultimate joint to the tip of the spine. Radials always visible, usually for a large part of their length, strongly concave on their anterior border, strongly produced in the interradial angles where they partially or entirely separate the first costals; costals and lower brachials in close apposition laterally, and more or less flattened; the costals and the joints of the ten arms are all rather long, the latter with a concave surface, making the ends prominent. The lower pinnules appear to be slender, with the first shorter than the second.

Color.—Light grayish brown.

Geographic distribution.—Bering Sea southward to the Antarctic Ocean, north in the Atlantic to the Abrolhos Islands, off the coast of Brazil.

Depth.—818 to 2,900 fathoms.

The elongation of the second cirrus joint and the interradial processes of the radials distinguish this genus at once from all others. The included species are,

B. abyssicola (P. H. Carpenter). *B. carpenteri* A. H. Clark.
B. brevicirra A. H. Clark. *B. minutissima* A. H. Clark.

Hypalometra gen. nov.

Genotype.—Antedon defecta P. H. Carpenter, 1888.

Radial faces longer than broad, the muscular fossæ large, the notch between them broad, but very shallow. Centro-dorsal hemispherical, or more or less sub-conical, thickly covered with cirri, a small polar area bare. Cirri twenty to thirty, with twenty to twenty-five joints, one or two of the basal about three times as long as wide, thence decreasing distally, the joints in the terminal half being squarish; no dorsal spines; opposing spine well developed. Radials visible, not extending much beyond the edge of the centro-dorsal; costals moderately long, well rounded, and widely separated laterally. Ten arms of rather long joints. First exterior and first interior pinnule absent; the lowest pinnule is that of the fifth brachial, which is borne on the outside of the arm; it is composed of (except the basal) elongate joints, and bears a genital gland; the following pinnules decrease in length, then increase again distally.

Color (in spirits).—White, the arms sometimes crossed with narrow transverse brown bands.

Geographic distribution.—Caribbean Sea, north to Florida.

Depth.—77 to 242 fathoms (Carpenter).

The hemispherical centro-dorsal bearing numerous cirri which have a moderate number of joints, elongate proximally, squarish distally, combined with the entire absence of oral pinnules (the lowest pinnule bearing a genital gland) distinguish this genus at once from all others. The only known species is the common

Hypalometra defecta (P. H. Carpenter).

Isometra gen. nov.

Genotype.—Antedon lineata P. H. Carpenter, 1888.

Centro-dorsal hemispherical or sub-conical, almost completely covered with cirrus sockets. Cirri about twenty-five in number with about thirty joints, subequal, approximately squarish, overlapping dorsally, the distal sometimes with more or less developed spines. Radials about even with the edge of the centro-dorsal; first costals oblong, about twice as broad as long; costal axillaries pentagonal, wider than long; the costals are rounded and entirely separated from each other. Ten smooth arms; brachials at first oblong or slightly wedge-shaped, broader than long, then becoming more obliquely wedge-shaped and as long as, or longer than, wide, becoming elongate distally. First two or three pinnules slender, "styliform," with elongate joints; following (genital) pinnules with the third and fourth joints expanded and broadly V-shaped.

Geographic distribution.—Only known from the south Atlantic, off Uruguay.

Depth.—600 fathoms.

This genus is readily distinguishable from all the other genera of Antedonidæ by the expanded joints of the genital pinnules. The only known species is,

Isometra angustipinna (P. H. Carpenter).

Isometra angustipinna is without doubt the young of *Antedon lineata* P. H. Carpenter, 1888 (not *Antedon lineatus* Pomel, 1887), which was renamed *challengeri* by A. H. Clark in 1907, before its relation to *angustipinna* was detected.

FAMILY PENTAMETROCRINIDÆ nom. nov.

Pentametrocrinus gen. nov.

Eudiocrinus P. H. Carpenter, 1882 (part), but not *Ophiocrinus* Semper, 1868 (not *Ophiocrinus* Salter, 1856).

Genotype.—*Eudiocrinus japonicus* P. H. Carpenter, 1882.

Costals absent, the first post-radial joint being the first brachial; no orals; five arms.

Color.—Purplish gray, the disk black.

Geographic distribution.—Intertropical; West Indies; coasts of southern Europe; coast of Somaliland eastward through the Indian Ocean to southern Australia, northward to Japan.

Depth.—103 to 1,050 fathoms; mainly abyssal.

Eudiocrinus was originally differentiated from "*Antedon*" on account of the possession of five undivided arms; and it seems to have escaped the notice of all subsequent workers on the comatulids that the undivided arms of the *Eudiocrinus indivisus* type are radically different in structure from those of the *Eudiocrinus japonicus* type. *Eudiocrinus indivisus*, *E. granulatus*, and *E. variegatus* (the first the type of the genus) have two costals united by syzygy, as in *Zygometra*, the genus to which they show the closest affinity; but they differ from *Zygometra* in that the second costal bears a pinnule instead of an additional arm. The third post-radial joint is the real first brachial, and is joined to the succeeding joint by synarthry, as the first brachial is joined to the second in all comatulids; there is, of course, no pinnule on this joint, as the first brachial never bears a pinnule; the fourth post-radial joint (*i. e.*, second brachial) is joined to the succeeding by an "oblique muscular" articulation, as are all second brachials to succeeding joints; it bears a pinnule on the side opposite to that on which the costal pinnule is borne, as a synarthrial articulation, like its derivative, a syzygy, not only never admits of the development of a pinnule, but is non-effective in regard to the pinnule developed on the next oblique muscular articulation, which, therefore, occurs on the same side as it would if the synarthry or syzygy were not there, but the two joints were merely a single joint. A muscular articulation, on the other hand, always affects the position of the next pinnule, no matter whether a pinnule is developed at the articulation or not, causing it to appear on the same side as the preceding pinnule; *Perometra* and *Cyllometra* and also *Erythrometra* are examples of this. Between the fifth and sixth post-radial joints (*i. e.*, the third and fourth brachials) occurs the first syzygy, which, therefore, occupies the same position as in *Zygometra* and in almost all other comatulids. In "*Eudiocrinus*" *atlanticus*, *E. japonicus*, *E. semperi*, *E. tuberculatus*, and *E. varians*, as in *Decametro-*

crinus and *Thaumatrocrinus*, the costals* are absent, and the first postradial joint is the first brachial. As an item of considerable interest it may be mentioned that in these species of "*Eudiocrinus*," in *Decametrocrinus*, *Thaumatocrinus*, and *Uintacrinus*, the first syzygy is between the fourth and fifth brachials, not between the third and fourth as is commonly the case; in analyzing the arms of *Uintacrinus*, it must be remembered that there are two distichals present, of which the second is not an axillary, so that the first brachial is the third joint from the costal axillary.

The genus *Pentametrocrinus*, as here defined, contains the following species:

P. atlanticus (Perrier). *P. semperi* (P. H. Carpenter).
P. japonicus (P. H. Carpenter). *P. tuberculatus* (A. H. Clark).
P. varians (P. H. Carpenter).

Some time ago I proposed the family Eudiocrinidæ to cover these species and *Decametrocrinus*, not being aware at the time that *Eudiocrinus indivisus* was so radically different. *Eudiocrinus* as here restricted belongs to the family Zygometridæ with the genus *Zygometra*, while *Pentametrocrinus* and *Decametrocrinus* may be united under the family name of **Pentametrocrinidæ**, which is the exact equivalent to what I intended by my "Eudiocrinidæ." Minckert's family "Decametrocrinidæ" must be rejected, it being composed of *Promachocrinus*, a genus of Antedonidæ very near *Heliometra*, and the utterly different *Decametrocrinus*.

The arm structure of *Thaumatocrinus* suggests that in reality it belongs to the Pentametrocrinidæ, near *Pentametrocrinus*.

The genera of free crinoids belonging to the Comatulida may be grouped as follows, the most specialized types being placed first.

FAMILY UINTACRINIDÆ.

Uintacrinus.

FAMILY COMASTERIDÆ.

Comatula. *Comaster.*

FAMILY ZYGOMETRIDÆ.

Eudiocrinus. *Zygometra.*

FAMILY HIMEROMETRIDÆ.

Himerometra. *Cyllometra.*
Poutiometra. *Oligometra.*

FAMILY TROPIOMETRIDÆ.

Tropiometra. *Calometra.*
Asterometra. *Ptilometra.*

* The costals are, in reality, merely repetitions of the two first brachials of the free arm interpolated between the regular first brachials and the radials; the distichals and palmars are additional reduplications of the two first brachials, either single (2) or double (4[3 + 4] or 4 [1 + 2; 3 + 4]), the two pairs in this latter case being separated by a muscular articulation like that at the distal end of all costal and division series.

FAMILY THALASSOMETRIDÆ.

Pœcilometra. *Thalassometra.*
Charitometra.

FAMILY ANTEDONIDÆ (restricted).

Perometra. *Leptometra.*
Erythrometra. *Hathrometra.*
Zenometra. *Iridometra.*
Psathyrometra. *Trichometra.*
Adelometra. *Bathymetra.*
Heliometra. *Nanometra.*
Promachocrinus. *Compsometra.*
Thaumatometra. *Hypalometra.*
Thysanometra. *Isometra.*
Coccometra. *Antedon.*

FAMILY PENTAMETROCRINIDÆ.

Decametrocrinus. *Pentametrocrinus.*
Thaumatocrinus.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

SMELL THE DOMINANT SENSE IN *DIABROTICA 12-PUNCTATA* AND *LIMAX MAXIMUS*.

BY ROBERT E. C. STEARNS.

The extraordinary acuteness of the sense of smell exhibited in many of the lower animals has been known so long that it is unnecessary to more than mention it. I recall numerous examples illustrating the extreme development of this sense as recorded in the literature, among the insects, the *Lepidoptera** especially, and in the *Mollusca*† in both marine and terrestrial species.

The following instances observed by me are not without interest, and worthy of notice, being of practical value.

The first occurred half a century ago, being one of various experiments of an agricultural character on my homestead acres, known as Claybrook in Norfolk County, Mass., in 1857–8.

In the spring of these years cucumber seed was planted on about half an acre, divided into two flats of nearly equal area by a roadway about ten feet wide. When the seed in the easterly plot had germinated and the first leaves began to peep above the ground the plants were protected by wooden frames twelve inches by twelve inches in size made of ordinary inch-thick boards. These frames were simply a box without a bottom, six inches in depth, the top covered with common mosquito netting. On the opposite or westerly side of the driveway, early peas were planted in rows, the rows being four feet apart. When the peas were four or five inches high the cucumber seed was planted in the space between every second

* Science Gossip, London, Hardwicke; various volumes.

† The Cambridge Natural History, Vol. III, *Mollusca*, pp. 192–196 and elsewhere.

row, so as to make the cucumber stands, or hills, eight feet apart each way, or 680 to the acre.

By the time the peas had made a growth of from eight to ten inches and the cucumber plants were showing their second or third pair of leaves, the spotted cucumber beetle *Diabrotica 12-punctata* made its appearance and commenced foraging. On the plot protected by frames, the beetles, to use a common expression, soon "struck the lead," and in many instances having worked their way under the edges of the frames, attacked the plants, doing considerable harm.

On the other plot the beetles were rarely seen, though as before stated, these plots were only ten feet apart. Here the pea odor not only neutralized the odor of the cucumber vines, but practically overwhelmed it. In volume of foliage, that of the pea vines or bushes compared with the leafage of the cucumber plants, was more than a thousand to one. The cucumber vines among the peas were not concealed from sight while those under the frames were materially obscured by the mosquito netting. It is during the early period of growth that the beetle is often exceedingly destructive. After the vines have become vigorously established the crisis as a general experience has passed, and the plants having attained a size so that their growth is restricted by the frames the latter have to be removed. The plants raised under frames may not be quite so hardy as those otherwise grown, but whether raised among the peas or under frames, in both cases considerable protection is given by these devices against unseasonable cold blasts such as not infrequently occur in backward or late springs.

Many years afterward when in Shawnee on the Delaware River in Pennsylvania, I noticed in a small vegetable garden that the owner protected his cucumber plants against the spotted beetle by dousing them with cow-manure diluted with water to the consistency of gruel or thin soup; this required repeating, as an ordinary rain storm would wash it off. It will be noticed that the odor of the manure overcame that of the cucumber vines, and is in the same line as the pea-cucumber experiment.

This method however is only practicable on a small scale. Where large areas of many acres are devoted to the cultivation of cucumbers, both the frame and Shawnee methods are unsatis-

factory. The latter because of the time and labor required, the frames because of the first cost and subsequent expense for repairs and the cartage to and from the field and storage when not in use, while the cultivation among peas has no limitation and two crops are produced on the same land to the pecuniary advantage of the grower. Aside from the value of the peas whether picked green or dried, the haul-in is excellent food for cattle and sheep; nothing is wasted, lost or without value.

In these latter days spraying with some insecticide is often resorted to. This is objectionable because of its poisonous character; it requires considerable labor and involves expense, while the pea-vine plan is scientific, natural and has no limitations; it is comparatively inexpensive, and ordinarily one season with another fairly profitable, not only in dollars and cents, but also from the point of view that like all leguminous crops, peas extract nitrogen from the atmosphere, and the soil from which a crop of peas has been harvested is richer in this fertilizing element than before the peas were sowed upon it.

It is not unreasonable to assume that other pestiferous insects may be thwarted, by careful experiment in the same line as pursued above with *Diabrotica*.

Regarding the sense of smell in the *Mollusca*, the testimony of many observers as recorded in the literature, so far as it goes, indicates that this sense is highly developed in the *Gasteropoda*, in both marine and land species. The well-known slug *Limax maximus*, a European form common in many localities on the Atlantic and Pacific coasts of the United States, is the only species that has particularly attracted my attention, though other related European species occur here and there in California. While none of our native slugs or snails, so far as I am aware, are regarded as pests these exotic slugs and the common *Helix aspersa* are under the ban as undesirable residents because of their destructive habits. They multiply rapidly, a small colony soon becoming a numerous community. Wherever they occur in considerable numbers it is hardly worth while to attempt making a lawn. The favorite mixture for seeding lawns in Los Angeles and elsewhere in the general region thereabout, is Kentucky Bluegrass, *Poa pratensis*, and the White Clover, *Trifolium repens*. With the earliest tinge of green upon the ground the slugs and snails make short work of the tender growth.

The *Limax** (*L. maximus*) is usually found in the rear of the house or back yard in crevices about the brick foundation, presumably attracted by the cooking odors of the kitchen. It is nocturnal in its habits. It makes its home under boards or piles of old bricks, in nooks and corners, preferring such places as are dark, damp and cool. At night it goes forth seeking what it may devour, and apparently always has a good appetite, and knows no such word as fail. In its foraging expeditions it makes a direct line, a short cut to the garbage can, if there is one, or whatever contains the refuse of the scullery; a greasy soup bone, even, does not escape attention. However distant these may be, or however dark the night, the sense of smell is the compass that guides, and it never loses the trail when on the home tack, returning to its hiding place about or soon after sunrise. Their slimy tracks when dry glisten like silver, and may be seen radiating like the spokes of a wheel where the hub or centre has been an old bone or piece of stale meat. Occasionally the slugs invade the kitchen and not infrequently their nightly excursions extend to the pantry.

Though a night traveler its eyes are apparently of little use, the exceeding development of the sense of smell compensating for lack or dimness of vision. With this in mind *Limax* can be diverted from its haunts when these are too near the house by keeping the garbage receptacle as far as possible away from the kitchen, and by furnishing cover near by in the shape of pieces of board, a pile of brick-bats or cobblestones in some dark, damp corner cool spot, and further by baiting with a greasy bone or stale fish, for the *Limax* is a scavenger and to a limited extent beneficial when seen in that light.

A slug-hunt should be in order once in a while, the oftener the better. The captives are easily killed by dropping them into any vessel containing strong brine. With these simple precautions they can soon be nearly if not quite cleaned out. When the kitchen or pantry is frequented fine salt liberally strewed on the floor near the threshholds may be used to advantage.

As to the seat of the sense of smell in the Insects and Mollusks, which has been discussed for many years, there is still a wide diversity of opinion. However, that is another story and need not be considered here.

* Nautilus, Vol. XVIII, Phila., July, 1904.

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PROCEEDINGS

OF THE

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A NEW WHITE-FOOTED MOUSE FROM ALASKA.

BY WILFRED H. OSGOOD.

In order to provide a name for immediate use in another connection, the following brief description is published of a white-footed mouse representing the form prevalent on most of the islands of southeastern Alaska. Although material is now available from nearly all these islands, a few points still remain to be cleared up regarding peculiarities of geographic distribution. Certain well-marked forms apparently are confined to particular islands while others, like the present one, show little or no differentiation from island to island. Very little variation in color appears among the several forms of the region and distinctions rest mainly on dimensions and cranial characters. In order not to anticipate unpublished results of a study of the large group to which this form belongs, it is given full specific rank with only limited discussion of relationships.

Peromyscus hylaeus sp. nov.

Type from Hollis, Kasaan Bay, Prince of Wales Island, Alaska. No. 127,038, U. S. National Museum, Biological Survey Collection. May 15, 1903. W. H. Osgood.

Geographic distribution.—Islands and coast of southeastern Alaska west and northwest of the range of *P. macrorhinus* including Prince of Wales, Kupreanof, Mitkof, and Admiralty islands and the mainland coast from Lynn Canal to Frederick Sound.

Characters.—Most similar to *P. keeni* of the Queen Charlotte Islands, but skull more lightly built with the rostrum longer and more slender; size decidedly less than in *macrorhinus* and *sitkensis;* color darker and ears and tail shorter than in *oreas.*

Color.—Practically as in *keeni, macrorhinus,* and other species of the humid Pacific coast; sides varying from russet to Mars brown shading to Mars brown and Prout Brown on the back; underparts white; tail sharply bicolor.

Skull.—Most similar to that of *oreas*, but nasals and rostrum averaging slightly more slender; similar to that of *keeni*, but more lightly built throughout; rostrum and nasals longer and more slender; posterior nasal endings usually exceeding premaxillæ; infraorbital region lighter; somewhat similar to that of *macrorhinus*, but decidedly smaller.

Measurements.—Average of 20 adult topotypes: Total length, 198.4 (191–205); tail vertebræ, 98 (91–105); hind foot, 23 (22–23.5); ear from notch (dry), 15.3 (14.5–16.8). Skulls of type and one topotype, respectively: Greatest length, 26.9; 27; basilar length, 21; 21; zygomatic width, 13.2; 14; interorbital constriction, 3.8; 3.9; interparietal, 9.6 x 3.2; 9.4 x 3; nasals, 10.5; 10.9; shelf of bony palate, 4; 4.2; palatine slits, 5.9; 6; diastema, 7.5; 7.4; postpalatal length, 9.1; 8.8; maxillary toothrow, 3.7; 3.9.

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OF THE

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THREE NEW RODENTS FROM COLORADO.

BY C. HART MERRIAM.

Merritt Cary, while engaged in a biological survey of Colorado for the U. S. Biological Survey, collected several undescribed species and subspecies of mammals. Three of these—a small chipmunk and a gopher from San Luis Valley and a woodrat from the juniper foothills of the southeastern corner of the State—are here described. The chipmunk I am naming for Merritt Cary; the woodrat for Edward R. Warren, author of an important annotated list of the Mammals of Colorado and first collector of the present form.

Eutamias minimus caryi subsp. nov.

Type from Medano Ranch, San Luis Valley, Colorado. No. 150,740 U. S. National Museum, Biological Survey Collection. ♂ yg. ad. Collected October 24, 1907, by Merritt Cary. Original No. 1176.

Characters.—Similar to *minimus* but paler and grayer. In fall pelage (late October) pale gray, most marked on neck and rump, and almost as clear on inner pair of light stripes; outer pair of white stripes purer white than in *minimus;* pale face stripes whitish in striking contrast with the alternating dark stripes.

Measurements.—Type: Total length, 194; tail vertebræ, 87; hind foot, 30. Average of 10 specimens from type locality: Total length, 194; tail vertebræ, 89; hind foot, 30.2.

Neotoma albigula warreni subsp. nov.

Type from Gaumes Ranch, northwest corner of Baca County, Colorado (alt. 4600 ft.). No. 151,051 U. S. National Museum, Biological Survey Collection. ♂ ad. Collected November 28, 1907, by Merritt Cary.

Characters.—Color gray, as in the widely different *N. micropus,* instead of buffy ochraceous as in *albigula,* to which it is most closely related; cheeks gray (in *albigula* strongly buffy or yellowish ochraceous); tail

black above and sharply bicolor as in *albigula;* feet white as in *albigula.* Skull peculiar.

Cranial characters.—Skull, compared with *albigula*, shorter and broader; rostrum much more swollen laterally; nasals broader and more squarely truncate anteriorly, longer (along median line) than frontal (in *albigula* subequal with frontal); frontal shorter; frontomaxillary suture (at anterior root of zygoma) straight (in *albigula* angular); zygomata heavier and somewhat more spreading; bullæ smaller and more rounded; molars heavier (broader).

Measurements.—Type specimen, male: Total length, 324; tail vertebræ, 137; hind foot, 36. An adult female from type locality: Total length, 330; tail, 146; hind foot, 34.

Thomomys talpoides agrestis subsp. nov.

Type from Medano Ranch, San Luis Valley, Colorado. No. 150,725 U. S. National Museum, Biological Survey Collection. ♀ ad. Collected October 29, 1907, by Merritt Cary. Original No. 1205.

Characters.—Size and general characters much as in *talpoides* but color very different—pale drab as in *ocius* instead of dark brown as in *talpoides;* skull also different.

Color.—Upperparts uniform drab, sometimes with a pale reddish (dull ochraceous) cast on top of head and neck; ear spots conspicuously dusky; underparts soiled whitish, the plumbeous underfur showing through.

Cranial characters.—Skull similar to that of *talpoides* but averaging longer and narrower; zygomata less spreading; nasals less regular, less truncate posteriorly, less straight on outer side—tending to spread outward on posterior third; premaxillæ longer and broader posteriorly; maxillary root of zygomata longer and broader and swollen to articulation with jugal so that the jugal part of arch is abruptly and conspicuously narrower; bullæ slightly more swollen.

Measurements.—Type: Total length, 220; tail vertebræ, 57; hind foot, 30. Average of 4 females from type locality: Total length, 212; tail vertebræ, 55; hind foot, 29.

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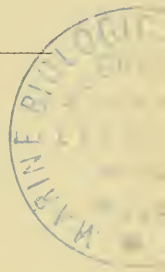

FOUR NEW RODENTS FROM CALIFORNIA.

BY C. HART MERRIAM.

Among the California mammals remaining undescribed in the collection of the Biological Survey are two Pocket Gophers from the Sierra foothills, and two Meadow Mice—one, a representative of the *mordax* group, from the San Bernardino Mountains in Southern California, the other, a member of the subgenus *Chilotus*, from South Yolla Bolly Mountain, a high summit of the inner Coast Range west of the Sacramento Valley. The new forms may be known from the following descriptions:

Microtus mordax bernardinus subsp. nov.

Type from Dry Lake, San Bernardino Mountains, California (altitude 9,000 feet, at north base San Gorgonio Peak). No. 150,632, U. S. National Museum, Biological Survey Collection. ♂ ad. Collected August 21, 1907, by Vernon Bailey. Original No. 8749.

Characters.—Similar externally to *M. mordax*.

Cranial characters.—Skull, contrasted with that of *mordax*, somewhat heavier and more angular; zygomata stronger and more spreading, nasals longer, broader anteriorly; frontal anteriorly more elevated and broader, with nasal and zygomatic processes (especially the latter) much more strongly developed.

Measurements of type specimen (in flesh).—Total length, 180 mm.; tail vertebræ, 56; hind foot, 21.

Remarks.—The Biological Survey has specimens of this form collected by Frank Stephens in August, 1903, on the ridge south of Bear Lake (altitude 7,800 feet), and from the same locality collected by Vernon Bailey in August, 1907, in addition to those from the type locality at north base of San Gorgonio Peak (also known as Grayback). I have seen two additional specimens, collected by Joseph Grinnell, from South Fork Santa Ana River.

Microtus oregoni adocetus subsp. nov.

Type from South Yolla Bolly Mountain, California. No. 137,995, U. S. National Museum, Biological Survey Collection. ♂ ad. Collected July 30, 1905, by A. S. Bunnell. Original No. 135.

Characters.—Size large for a *Chilotus;* ears small and nearly concealed in the fur; color of upperparts sepia or reddish sepia brown, very much paler than *oregoni;* underparts dull buffy, the dark underfur showing through; tail dark brownish, paler below; feet whitish.

Cranial characters.—Skull similar to that of *oregoni* but larger and heavier, with longer rostrum, larger and less depressed nasals, much larger anterior nares, and larger teeth.

Measurements.—Type specimen: Total length, 172; tail vertebræ, 49; hind foot, 21. Cranial measurements: Basal length, 24.5; basilar length of Hensel, 23.5; zygomatic breadth, 16; palatal length (notch to incisors), 13.

Thomomys mewa sp. nov.*

Type from Raymond, Madera County, California. No. 133,183, U. S. National Museum, Biological Survey Collection. ♂ ad. Collected June 28, 1904, by N. Hollister. Original No. 908.

Characters.—Not closely related to any known species. Size rather small; has two marked and widely different pelages; summer pelage red above and below, varying from fulvous to almost ferruginous; winter pelage dusky (much darker than typical *bottæ*), overlaid by a light peppery wash of russet brown; underparts in winter dark plumbeous strongly washed with buffy ochraceous.

Cranial characters.—Skull peculiar; smaller than either *bottæ* or *pascalis* and slightly larger than *navus*—from which latter it differs in such radical characters as not to require comparison (*navus* having the nasals exceedingly small and short, the zygomata widely spreading *posteriorly*, the upper incisors projecting strongly forward). Nasals rather long and *straight-sided* as in *pascalis* (not narrowed posteriorly and expanded anteriorly as in *bottæ*); zygomata rather squarely spreading, with strongly marked and thickened anterior angle; bullæ and premaxillæ normal, as in *bottæ;* temporal impressions nearly parallel and 4–5 mm. apart in adult males; interparietal subquadrate, convex anteriorly. The type specimen is in the molt and the new red pelage which covers all but the rump is still short and paler than the full summer pelage.

Measurements.—Total length, 225; tail vertebræ, 60; hind foot, 27.

Range.—The Upper Sonoran or Digger Pine belt along the west flank of the Sierra from northern Tuolumne County south to Kern Valley.

Thomomys alpinus awahnee† subsp. nov.

Type from Yosemite Valley, California. No. 133,076, U. S. National Museum, Biological Survey Collection. ♀ ad. Collected June 14, 1904, by N. Hollister. Original No. 870.

Characters.—Size rather small; similar in general to *alpinus* but smaller, with decidedly smaller fore claws and skull.

* Named from the Mewa Indians, within whose territory the type region lies.

† Named from Ahwahnee, the original Indian name of Yosemite Valley; used also for the band or subtribe inhabiting the valley.

Color.—Muzzle and inner side of opening of cheek pouches usually dusky; winter pelage dusky, lightly washed with sepia brown, sometimes becoming ochraceous on sides of neck; summer pelage varying from dull russet brown to almost ochraceous, brightest on sides of neck and (less so) on flanks.

Cranial characters.—Skull resembling that of *alpinus* but much smaller; nasals small and *narrow anteriorly*, with sides nearly parallel; interparietal broader than long; zygomata not broadly spreading, broadest posteriorly; bullæ *small* and smoothly rounded, lacking the antero-external prominence of *alpinus;* occiput bulging.

Measurements.—Type specimen, ♀ ad.: Total length, 194; tail vertebræ, 54; hind foot, 28. An adult male from type locality: Total length, 194; tail vertebræ, 69; hind foot, 27.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

TWO NEW CRINOID GENERA.

BY AUSTIN HOBART CLARK,

U. S. Bureau of Fisheries.

A critical study of the arm structure and the brachial homologies in the recent representatives of the family Pentacrinitidæ has made it evident that we are at present confusing, under the name of *Isocrinus* (= *Pentacrinus* of P. H. Carpenter) three quite distinct types, one of which occupies, in certain ways, an intermediate position between the others and *Metacrinus*. In *Metacrinus* we have a condition similar to that found in the Pentametrocrinidæ, costals being absent altogether (see these Proceedings, *antea*, p. 134), the only difference being that in *Metacrinus* the arms branch, sometimes as many as five or six times, while in the Pentametrocrinidæ the arms are undivided. In *Isocrinus asteria*, *I. blakei*, and *I. decorus*, costals are present, but the arm distal to the first axillary is strictly comparable to the *entire* arm in *Metacrinus;* that is, in these three species, no matter how many times the arms divide, they are strictly homologous with the arms in a *ten-armed* comatulid (excepting, of course, *Decametrocrinus* and *Uintacrinus*), and are not at all homologous morphologically (though strictly analogous physiologically) to the arms of a multibrachiate comatulid. In *Isocrinus alternicirrus*, *I. parræ*, *I. sibogæ* and *I. wyville-thomsoni* the arms are morphologically and physiologically homologous with the arms of multibrachiate comatulids, being composed of costals, distichals, palmars, and one or two post-palmar series before the undivided free arms are reached.

The fact that the arm division in each case results in an isotomous dichotomy appears to have led students to consider it as strictly similar; but while in *Isocrinus alternicirrus*, *I. parræ*, *I.*

sibogæ and *I. wyville-thomsoni* arm reduplication is effected by the interpolation of various division series which in reality are mere repetitions of the first two joints of the free undivided arm, as in multibrachiate comatulids, in *Metacrinus* the arm reduplication results from a splitting of the arm at more or less uncertain intervals.* The former I call *interpolated division*, the latter *extraneous division*. In *Isocrinus asteria*, *I. blakei*, and *I. decorus*, we find a combination of these two modes of arm division; the first arm division (and the first only) is an *interpolated division*, those following are *extraneous divisions*. In *Metacrinus* and these two divisions of *Isocrinus*, the first post-radial joints bearing pinnules are in all cases homologous, regardless of the number of joints intervening between them and the radials; this is shown by the articulation between them and the succeeding joint being a muscular articulation in which the transverse ridge separating the dorsal ligament fossa from the interarticular ligament fossæ is strongly oblique; that is, an *oblique muscular articulation*, as opposed to a muscular articulation where the transverse ridge is at right angles to the dorso-ventral axis of the joint face, or a *straight muscular articulation*. The first *oblique muscular articulation* occupies morphologically the same position in the arms of all comatulids, and in all the recent Pentacrinitidæ, and is followed exclusively by articulations of the same type, interspersed with occasonal syzygies; proximal to the first *oblique muscular articulation*, only *straight muscular articulations* and *synarthries* or *bifascial articulations* (which may in any or all cases be replaced by *syzygies*) occur. The first *oblique muscular articulation* in *Metacrinus* and the two divisions of *Isocrinus* is always found on the distal end of the joints bearing the first pinnule.

The *Isocrinus asteria* group is, in arm structure, intermediate between the *I. parvæ* group in which only *interpolated* division is found, and *Metacrinus*, which has only *extraneous* division, as it has one *interpolated* series, followed by one or more *extraneous*

* In both sections of *Isocrinus*, as in the multibrachiate comatulids, the young are ten-armed, the multibrachiate condition arising, as explained by Minckert, through a process of autotomy by which the original arms break off at the articulation between the first and second brachials of the undivided arm, or the third and fourth post-radial joints. Now in *Metacrinus* the first two post-radial joints correspond to these first two post-costal joints in young *Isocrinus;* therefore, it is reasonable to suppose that the very young of *Metacrinus*, having but five articulations when autotomy is possible instead of ten as in *Isocrinus*, will be found to possess but five arms.

series. It therefore appears that, if *Metacrinus* be deemed worthy of generic rank, which no one has questioned, the two divisions of the genus now known as *Isocrinus* are equally entitled to generic rank, as they are as different from each other as the *I. asteria* group is from *Metacrinus*.

The species of the *Isocrinus asteria* group are congeneric with the fossil *Isocrinus pendulus* of von Meyer, which is the type of *Isocrinus* of L. Agassiz, and several other genera have been founded on other species of the same group. No generic name has so far been given to any species of the *I. parræ* group, and I propose to differentiate them from the *I. asteria* group under the name Endoxocrinus.

The peculiar species described by Dr. P. H. Carpenter as *Pentacrinus naresianus* differs in some important characters both from *Endoxocrinus* and from the remaining species of *Isocrinus* and appears to be worthy of rank as a separate genus.

Endoxocrinus gen. nov.

Genotype.—*Eucrinus parræ* Guérin, 1835 (= *Pentacrinus mülleri* Örsted, 1856).

A genus of Pentacrinitidæ in which the first two post-radial joints are united by syzygy, and the isotomous division series are all of two joints united by syzygy (*interpolated*); the first *oblique muscular articulation* is between the second and third brachials beyond the last axillary; infrabasals always (?) absent, and interior ends of basals more or less resorbed, the primary axial canals forking and entering the basals through two apertures;* basals large and broad, forming, when viewed dorsally, a rounded-pentagonal figure.

Geographic Distribution.—Caribbean Sea and Gulf of Mexico; Atlantic coasts of southern Europe and northern Africa (with the outlying islands); East Indies; not known as a fossil.

Depth.—84–1095 fathoms.

The following species are included in this genus:

E. alternicirrus (P. H. Carpenter).

E. parræ (Guérin).†

* Reichensperger (Bull. Mus. Comp. Zool. Vol. XLVI, No. 10, p. 173, December, 1905) figures the condition of the axial canals in *Endoxocrinus parræ*, misidentified as *Isocrinus* ("*Pentacrinus*") *decorus*. The course of the canals in the latter species is quite different.

† This species, which inhabits the shallowest water of any of the genus, is extraordinarily variable, while the others appear to be pretty constant in their characters; this accords with the rule that a species of a genus which occupies a habitat on the borders of the habitat of the genus as a whole, either geographically or bathymetrically, is more variable than are the other species of the same genus; thus *Rhizocrinus lofotensis* and the corresponding species on the American coast are very commonly

E. sibogæ (Döderlein).
E. wyville-thomsoni (Wyville-Thomson).

Hypalocrinus gen. nov.

Genotype.—Pentacrinus naresianus P. H. Carpenter, 1882.

A genus of Pentacrinitidæ in which the first two post-radial and first two post-costal joints are united by synarthry; a single *interpolated* series is present; no further division; the first *oblique muscular articulation* is between the second and third brachials beyond the only axillary; infrabasals?; basals as in *Endoxocrinus*, and not narrow, forming a rounded stellate figure, as in *Isocrinus*.

Geographic distribution.—Kermadec Islands, Fiji, Celebes, and Philippines.

Depth.—500–1350 fathoms.

The only known species is:

H. naresianus (P. H. Carpenter).

The species remaining in *Isocrinus* as here restricted are (in addition to numerous fossil species):

I. (*Cenocrinus*) *asteria* (Linnæus).
I. (*Isocrinus*) *blakei* (P. H. Carpenter).
I. (*Isocrinus*) *decorus* (Wyville-Thomson).

six-rayed, while the numerous species of the same genus within the normal tropical area are invariably five-rayed, and the most variable species of *Metacrinus*, *M. rotundus*, is also the most northerly of the genus; it is the same with species; the examples taken farthest from the center of distribution, or at the limits of distribution, are the most variable; *Tropiometra carinata*, constant in its characters from East Africa to Oceania, is extremely variable in Brazil; *Antedon bifida* is more variable about the British coasts than in the Mediterranean, and *Heliometra eschrichtii* varies most along the southern limit of its range.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NOTES ON A COLLECTION OF ALGÆ FROM GUATEMALA.

BY JOSEPHINE E. TILDEN.

While engaged in collecting plants, more particularly rusts, in the neighborhood of Lakes Amatitlan and Atitlan, Guatemala, Dr. W. A. Kellerman and Mr. A. L. Smith, both of the Ohio State University, made a collection of algæ which was sent to me for study. The following list of species is the result of my work.

MYXOPHYCEÆ.

Microcystis flos-aquæ.

Microcystis flos-aquæ (Wittr.). Kirchn. in Engler and Prantl, Nat. Pflanz. 1, 1a. 56, f. 49 N. 1900.

Cells 4–6.5 mic. in diameter, globose, densely aggregated to form solid or clathrate, oblong or elliptical colonies; colonies up to 175 mic. long. Associated with *Anabæna flos-aquæ* and *Eudorina elegans*. Lake Amatitlan. Temperature of water 73°. "Very abundant." Collected with a surface net. W. A. Kellerman (no. 5034), S. E. Meek, and A. L. Smith, January 14, 1906.

Oscillatoria boryana.

Oscillatoria boryana Bory., Dict. 12:465. 1827.

Stratum dark chalybeous; plants forming a regular spiral through their entire length, flexible, slightly constricted at joints, 6-8 mic. in diameter, with an acute, non-capitate apex; cells 4–6 mic. long, showing a few scattered granules; cross walls granular; apical cell rounded or acute-conical; calyptra none. Forming a dark velvety mass in a small stream of warm water, a little distance from a hot spring, on bank of river. Altitude 3,950 feet. Rio Michatoya, near Lake Amatitlan. W. A. Kellerman (no. 5051), January 25, 1906.

Phormidium valderianum.

Phormidium valderianum (Delp.). Gomont, Monogr. des Oscill. in Ann. Sci. Nat. Bot. VII, 16: 167. pl. 4. f. 20. 1892.

Stratum slimy, expanded, lamellose, 8 mm. thick, the upper layers dull green, the internal layers whitish; trichomes aeruginous, straight, not attenuate at apex, not constricted at joints, 2–2.5 mic. in diameter; cells somewhat longer than the diameter, 3.3–6.7 mic. long; apical cell rotund; calyptra none. Associated with *Nodularia harveyana*. Laguna, Lake Amatitlan. Altitude 3,950 feet. W. A. Kellerman (no. 4304), February 8, 1905.

Phormidium laminosum.

Phormidium laminosum (Ag.) Gomont, in Journ. de Bot. 4:355. 1890.

Stratum forming a dark-colored or reddish, firm crust; plants flexuose, densely intermingled; sheath narrow, more or less distinct; trichomes pale bluish-green, not constricted at the joints, with straight, briefly attenuated, non-capitate apex, 1–1.5 mic. in diameter; cross walls not visible. Near Lake Amatitlan. In a pool of very warm water close to a hot spring. W. A. Kellerman (no. 5053), January 25, 1906.

Phormidium uncinatum.

Phormidium uncinatum (Ag.) Gomont, in Journ. de Bot. 4:355. 1890.

Stratum widely expanded; plants straight or somewhat flexuous; sheath not distinct; trichomes aeruginous, not constricted at the joints, 6–9 mic. in diameter, briefly attenuated at the apex, capitate, curved or briefly spiral; cells 2–3 times shorter than the diameter, 2–6 mic. long; cross walls frequently lined with granules; apical cell having a rotund calyptra. Lake Amatitlan. On rocks at the edge of lake and also on *dry* rocks, same locality. W. A. Kellerman (nos. 5063 and 5067), January 28, 1906.

Lyngbya martensiana.

Lyngbya martensiana Menegh., Conspectus Algol. euganeæ. 12. 1837.

Plants elongate, somewhat flexuous, flexible; sheath hyaline; trichomes pale blue-green (violet in dried material), not constricted at the joints, with non-attenuate apex, 6–10 mic. thick; cells shorter than the diameter, 1.7–3.3 mic. long; cross walls visible; apical cell rotund; calyptra none. On stems of *Scirpus*, dead or dying. Lake Amatitlan. W. A. Kellerman (no. 5061), January 28, 1906.

Lyngbya lagerheimii.

Lyngbya lagerheimii (Moeb.) Gomont, Journ. de Bot. 4:354. 1890.

Plants more or less regularly spiral or straight; sheath thin, hyaline; trichomes about 2 mic. in diameter; cells shorter or longer than the diameter, 1.2–3 mic. long; cross walls marked by two refringent granules (not visible in the preserved specimens). On stems and on lower branches of a tree which had been cut off and thrown into water. Lake Amatitlan. W. A. Kellerman (no. 5068), January 30, 1906.

Nodularia harveyana.

Nodularia harveyana (Thwaites) Thuret, Ann. Sci. Nat. Bot. VI, 1: 378. 1875.

Plants slender, 4–5 mic. in diameter, attenuate at ends, terminated by an obtusely conical cell; sheath extremely delicate, hyaline, distinct; cells before division equal to or a little longer than diameter; heterocysts subquadrate, somewhat longer than wide, of the same width as the cells; gonidia somewhat globose, yellowish-dark-colored (in this material bright aruginous, probably immature), 5–8 mic. in diameter. Associated with *Phormidium valderianum*. Laguna, Lake Amatitlan; altitude 3,950 feet. W. A. Kellerman (no. 4304), February 8, 1905.

Anabæna flos-aquæ.

Anabæna flos-aquæ (Lyngb.) Bréb. in Brébisson & Gody, Algues des environs de Falaise, 36. 1835.

Colonies frothy, gelatinous, floating; plants circinate, 4–8 mic. in diameter; cells spherical-compressed, 6–8 mic. in length; heterocysts a little larger than ordinary cells; gonidia curved, oblique, 7–13 mic. in diameter, 20–35 mic. long, near the heterocyst. Associated with *Microcystis flos-aquæ* and *Eudorina elegans*. Lake Amatitlan. Temperature of water 73°. "Very abundant." Collected with a surface net. W. A. Kellerman (no. 5034) S. E. Meek, and A. L. Smith, January 14, 1906.

Stigonema ocellatum.

Stigonema ocellatum (Dillw.). Thur. Ann. Sci. Nat. Bot. VI, 1: 380. 1875.

Cæspitose, pannose, tomentose, dark-colored; plants erect, 3–8 mm. high, irregularly branched; branches long, straight, patent, scarcely more slender than primary filaments, 35–45 mic. in diameter; sheath thick, lamellose, hyaline or yellowish; cells of varied sizes, in one or two rows, bluish-green, 20–30 mic. in diameter; heterocysts rare, lateral. Growing on edges of steam-holes on side of Volcano Santa Maria, near Lake Atitlan. W. A. Kellerman. (no. 5070), February 3, 1906.

CHLOROPHYCEÆ.

Spirogyra sp.

Spirogyra sp.; sterile.

In pool near river. Rio Michatoya. W. A. Kellerman (no. 5050) January 25, 1906.

Spyrogira sp.; sterile.

In still water. Lake Amatitlan, south end. W. A. Kellerman (no. 5062) January 28, 1906.

Pleurococcus vulgaris.

Pleurococcus vulgaris Menegh. Nostoch. 38. no. 6. pl. 5. 1846.

On cedar planks at edge of lake. Lake Amatitlan. W. A. Kellerman (no. 5066), February 1, 1906.

Eudorina elegans.

Eudorina elegans Ehrenb. in Monatsb. der Akad. d. Wissensch. zu Berlin. 78, 152. pl. 2. f. 10. 1831.

Associated with *Microcystis flos-aquæ* and *Anabæna flos-aquæ*. Lake Amatitlan. Temperature of water 73°. "Very abundant." Collected with a surface net. W. A. Kellerman (no. 5034), S. E. Meek and A. L. Smith, January 14, 1906.

Chætophora sp.

Chætophora sp.

Colonies very small, bright green, soft, flat, confluent; filaments radiating from the center, dichotomously branched, erect and subparallel, not fasciculate at summit; terminal branches finely pointed, not setiferous; cells of main filament 5–6 mic. wide, 4–5 times as long. On old twigs and stems of woody plants which had been thrown in the water in a sheltered place. Lake Amatitlan. W. A. Kellerman (no. 5069), June 30, 1906. This material is in a young condition, somewhat abnormal, and softened by formalin.

Melosira granulata.

Melosira granulata (Ehr.) Ralfs in Pritch. Inf. 820. 1861.

In bottom of river with very swift current. Two feet deep. Rio Michatoya, one-half mile from Lake Amatitlan of which this river is an outlet, Altitude 3,950 feet. W. A. Kellerman (no. 5054), January 26, 1906.

? Batrachospermum sp.

? *Batrachospermum* (*Chantransia* stage).

Cells of main filament 13 mic. wide, 37–65 mic. long. No reproductive cells present. Associated with *Lyngbya lagerheimii*. On stems and on lower branches of trees in water. Lake Amatitlan. W. A. Kellerman (no. 5068), January 30, 1906.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NOTES ON BIRDS FROM WESTERN COLOMBIA.

BY OUTRAM BANGS.

A short time ago I received from Mr. W. F. H. Rosenberg intact, a small collection of birds made in northwestern Colombia just south of Darien by one of his field collectors, Mervyn G. Palmer. Although it contained but 110 species and subspecies, it is rich in rare and new forms, and should future installments from Mr. Palmer prove equally interesting a list of the birds of the region will be published.

While the birds of Panama and of northwestern Ecuador are now fairly well known, and the ornis of the two regions presents many points of affinity, strangely enough but little bird collecting has been done in western Colombia, the link connecting the two.

Mr. Rosenberg himself did some work here thirteen years ago; his bird collections, however, were small; still a few forms have been named that are apparently peculiar to this general region.

Among the better things in the present collection not specially commented upon below are examples of:

Nothocercus intercedens Salvadori.
Chloronerpes gularis Harg.
Veniliornis dignus (Scl. & Salv.).
Phaethornis symatophorus symatophorus Gould.
Adelomyia melanogenys cervina Gould.
Formicarius rufipectus Salv.
Pachyrhamphus dorsalis Scl.
Planesticus obsoletus colombianus (Hart. & Hellmayr).
Planesticus ignobilis goodfellowi (Hart. & Hellmayr).
Leucolepis dichrous (Scl. & Salv.).
Thryophilus nigricapillus schottii (Baird).
Chlorochrysa nitidissima Scl.
Iridornis porphyrocephala Scl.

Following are short descriptions of a few forms that appear to be new, and notes upon one or two other species:

Neocrex colombianus Bangs.

Neocrex colombianus Bangs, Proc. Biol. Soc., Washington, Vol. XII, p. 171, Oct. 31, 1898—Palomina, Sierra Nevada de Santa Marta, Colombia.

Neocrex uniformis, Hartert, Nov. Zool. VIII, p. 369, Oct. 5, 1901—western Ecuador.

One adult male from San Antonio, western Colombia, December 2, 1907, is quite like my type in every respect except that the brown of back and wings is just a trifle darker, more olivaceous, the difference probably being seasonal, the type of *Neocrex colombianus* having been taken May 22.

I can find no character in Hartert's description of his birds from western Ecuador that does not apply also to my Colombian examples, and feel sure that in *Neocrex uniformis* he simply redescribed *Neocrex colombianus*.

Aulacorhamphus petax sp. nov.

Type from San Antonio, Rio Cali, western Colombia, altitude 5,800 feet, adult ♂, No. 20570, coll. of E. A. and O. Bangs. Collected Nov. 5, 1907, by M. G. Palmer.

Characters.—Similar in general to *A. albivittus* (Boiss.) but throat blue instead of grayish white. The bill of the new form is similar to that of *A. albivittus*, with a dark chestnut base to lower mandible followed by a broad white band which extends across both mandibles. There is, however, present in both specimens of the new form, a white band across extreme base of culmen which I do not find in any of the examples of *A. albivittus* examined.

The new form, which may be a western subspecies of *A. albivittus*, needs close comparison with no other member of the genus. From the other two species having blue throats, *A. cæruleigularis* Gould of Costa Rica and Panama, and *A. cyanolæmus* Gould of western Ecuador, it differs in having chestnut at base of lower mandible and in the shade of the throat which though blue is paler than in either of these. *A. lautus* Bangs of the Sierra Nevada de Santa Marta, Colombia, another member of this group of the genus, has the base of the lower mandible anterior to the white band wholly black, the black portions of culmen more extensive and yellow portions more restricted, the white band across sides of upper mandible bordered behind by yellow and the throat bluish gray.

MEASUREMENTS.

No.	Sex.	Wing.	Tail.	Tarsus.	Culmen.
20,570	Type ♂ ad.	131.	121.	33.	73.
20,569	Topotype ♀ ad.	127.	112.	32.5	61.

Premnoplex brunnescens (Sel.).

One adult ♀ *Premnoplex brunnescens* from San Antonio, appears to represent the typical form originally described from Bogota, agreeing with Sclater's description and plate, and it appears to me that apart from

P. stictonota (Berl.) of western Bolivia, three well marked geographic races should be recognized, as follows:

Premnoplex brunnescens brunnescens (Scl.).

Central and western Colombia to Peru.

Wings, tail and ground color of under parts all very dark brown; spots on under parts large, clearly defined, fulvous; throat, ochraceous.

Premnoplex brunnescens coloratus (Bangs).

Sierra Nevada de Santa Marta, Colombia.

Wings, tail, ground color of under parts, and back, all richer or redder brown, less blackish, most of spots on under parts and throat ferruginous.

Premnoplex brunnescens brunneicauda (Lawr.).

Costa Rica, Chiriqui and Veragua.

Much grayer or more olivaceous brown throughout, spots on under parts much paler and less sharply contrasted with ground color, and less distinctly bordered with blackish; throat dull fulvous.

Henicorhina leucophrys guttata (Hartl.).

Three specimens, two adult males, one youngish female, San Antonio, western Colombia.

These three skins belong to a form of the gray-breasted wood wren that appears to me well characterized and that tallies as well as can be expected with Hartlaub's short description of his *Troglodytes guttatus* from New Grenada.*

Ridgway, in part III of his Birds of North and Middle America, skilfully untangled the races of *Henicorhina* and arranged them under five species in a most satisfactory way. He, however, said he was unable to consult Hartlaub's description of *Troglodytes guttatus* and suggested that that bird might be his *Henicorhina hilaris bangsi*. There is in the library of the Museum of Comparative Zoölogy at Cambridge, Mass., a copy of Hartlaub's work, and the short Latin description of *Troglodytes guttatus* seems to me certainly to have been drawn up from a gray-breasted, black-headed *Henicorhina* and not from a member of the *hilaris* group.

The three skins in the present collection do not agree in subspecific characters with any of the races of *Henicorhina leucophrys* recognized by Ridgway, differing from *H. leucophrys leucophrys* (Tsch.) of Peru in having the black postocular streak not extended below the eye, but as in *H. leucophrys colina* (Bangs) of Costa Rica and Chiriqui, the cap, however, is sooty blackish throughout in the males, scarcely shaded at all with brownish medially; the female (which also appears to be youngish) has the cap brownish medially. From *H. leucophrys colina* the Colombian birds differ in several characters in addition to their blacker heads, more noticeable of which are, that the white superciliary streak is much wider and is broadly continued forward directly to nostril; throat whiter, less grayish and less streaked with black; breast slightly paler gray and flanks decidedly paler brown; brown of back of the same shade as in *H. l. colina*.

* Syst. Verz. d. Ges. Mus. Brem., 1844, p. 28.

Henicorhina leucophrys guttata, if I am right in referring the three specimens before me to that form, as I think I am, apparently needs comparison with none other of the subspecies of *H. leucophrys*, being much darker than *H. l. berlepschi* Ridg. of western Ecuador or than any of the Mexican and Guatemalan races.

Basileuterus melanotis daedalus subsp. nov.

Type from San Antonio, Rio Cali, western Colombia, 5,800 feet altitude, adult ♂, No. 20709, coll. of E. A. and O. Bangs. Collected December 27, 1907, by M. G. Palmer.

Characters.—Similar to *Basileuterus melanotis melanotis* Lawr. of Costa Rica and Panama, but upper parts greener—olive green, less olive or greenish-olive; under parts much more buffy yellow—about maize yellow (in *B. melanotis melanotis* the under parts are between canary and sulphur yellow); auricular region with much more black, only a small spot below the eye buffy; black loral spot much larger, involving the whole of the lores.

MEASUREMENTS.

No.	Sex.	Wing.	Tail.	Tarsus.	Exposed Culmen.
20,709	Type ♂ ad.	63.	55.	21.	11.5
20,708	Topotype ♀ ad.	60.5	53.	21.	10.5

Dacnis venusta fuliginata subsp. nov.

Type from Jimenez, western Colombia, (altitude 1,600 feet) adult ♂, No. 20229 coll. of E. A. and O. Bangs. Collected February 23, 1907, by M. G. Palmer.

Characters.—Similar in color pattern to true *D. venusta* Lawr. of Panama and Costa Rica, but with under parts much deeper black—throat, breast and under tail coverts deep sooty black, a faint greenish tinge on belly only. (In true *D. venusta* the entire under parts except, of course, the thighs, are dark, greenish black—"invisible green" Ridgway.) Smaller, with a much smaller bill.

Measurements.—Type, adult ♂: wing, 63; tail, 39; tarsus, 14.5; exposed culmen, 10.5. (Fifteen adult males of true *D. venusta* in my collection from Panama and Costa Rica afford average measurements of about: wing, 67.5; tail, 41.5; tarsus, 15.5; exposed culmen, 12.5.)

Calospiza gyroloides deleticia subsp. nov.

Type from San Antonio, western Colombia, altitude 5,800 feet, adult ♂, No. 20508, coll. of E. A. & O. Bangs. Collected Dec. 6, 1907, by M. G. Palmer.

Characters.—Like true *C. gyroloides* (Lafr.) of Central America, in all respects except that the lesser wing coverts ("shoulders") are *green* not *yellow*—paler, more yellowish and more shining green that the rest of the

wing, but very different from the bright yellow shoulder of the Central American bird. All three skins in the present collection (two adult males and one adult female) agree in this respect and are like one adult male in my collection from Rio Lima, Colombia, and several "Bogota" skins. In an enormous series of true *C. gyroloides* from north of the Isthmus of Panama, not a single adult specimen but shows the distinct yellow shoulder.

Atlapetes crassus sp. nov.

Type from San Antonio, western Colombia, altitude 5,800 feet, adult ♂, No. 20524, coll. of E. A. and O. Bangs. Collected Dec. 11, 1907, by M. G. Palmer.

Characters.—A large species with a heavy bill almost as stout as in *Lysurus*, dark olive above, bright yellow below, and with the crown tawny olive.

Color.—Central part of crown to occiput tawny-olive; sides of crown black; cheeks dusky brown; rest of upper parts blackish olive; wings and tail dusky, edged with dull olive; throat chrome yellow; becoming brighter more gamboge along middle of belly; sides, flanks and under tail coverts olive green; bend of wing bright yellow; lining of wing yellowish white.

Measurements.—Type, adult ♂: wing, 78; tail, 79; tarsus, 25.5; exposed culmen, 16.5.

Remarks.—I can find no described species of *Atlapetes*, *Lysurus* or *Buarremon* that appears to come at all close to the present bird, and while it is possible I have overlooked some name that may apply to it, I do not think I have.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

A NEW TYRANT-BIRD FROM THE SANTA MARTA REGION OF COLOMBIA.

BY OUTRAM BANGS.

Lately while identifying birds in a collection from Brazil, which contained examples of true *Rhynchocyclus sulphurescens* (Spix), I was much puzzled by the series from Santa Marta, Colombia, which I had always referred to that form. On close comparison the Santa Marta bird proves different from any form of the genus I can find descriptions of * and I feel compelled to give it a name. The Santa Marta series was kindly examined and compared with all material in Washington, for me, by H. C. Oberholser who agrees with me that it represents an undescribed subspecies.

Rhynchocyclus sulphurescens exortivus subsp. nov.

Type from La Concepcion, Sierra Nevada de Santa Marta, Colombia, (altitude 3,000 feet) adult ♂, No. 6703, coll. of E. A. and O. Bangs. Collected March 16, 1899, by W. W. Brown, Jr.

Characters.—Similar to true *R. sulphurescens* of Brazil but smaller and much paler in color—gray of crown, olive-green of back and yellow of under parts all much paler than in Brazilian skins. From *R. flavo-olivaceus* of Panama, the Santa Marta form differs very much in its grayer cap and much less yellowish coloration throughout.

Measurements.—Adult male: wing, 64–67; tail, 55–59; tarsus, 16.5–18; exposed culmen, 11.5–13 (five specimens from the Santa Marta Mountains). Adult female: wing, 64–64.5; tail, 55–58; tarsus, 17.5–18; exposed culmen, 12–13 (two specimens from the Santa Marta Mountains).

* Count Von Berlepsch (Proc. IVth Int. Orn. Cong. 1905, p. 482) asserts that *Rhynchocyclus scotius* Oberh. is *Rhynchocyclus sulphurescens assimilis* (Pelz.).

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NOTES ON THE BREEDING HABITS OF *PHRYNOSOMA CORNUTUM* AND OTHER TEXAS LIZARDS.

BY JOHN K. STRECKER, JR.

Baylor University, Waco, Texas.

Our knowledge concerning the breeding habits of the lizards of the genus *Phrynosoma* is rather limited. The majority of our herpetologists have either been so situated that they could not study these animals in their natural surroundings or have been satisfied to accept the oft-repeated statement that all horned lizards produce living young. As a natural result, there are many naturalists who are not aware that *Phrynosoma* as well as *Sceloporus*, contains both oviparous and viviparous species. In the genus *Sceloporus*, only one species (*S. viviparus* Cope)* is certainly known to produce living young while all of the others are supposed to lay eggs. In *Phrynosoma*, the case is exactly reversed and only one species is known to be oviparous. This is the very common Texas horned lizard (*Phrynosoma cornutum* Harlan), and after a very careful survey of the literature on the subject, I believe that I am the first writer to call attention to this fact.†

In the writings of Cope, Boulenger, Lydekker, and others, it is stated that the lizards of the genus *Phrynosoma* and one species of *Sceloporus* are the only iguanoids that are known to be viviparous. Mr. Raymond L. Ditmars, in his excellent work‡ speaks of the viviparity of the horned lizards, and states that the young usually number from 6 to 12. On plate 39 he shows a photo of two young examples of *Phrynosoma d. hernandesi* only two hours old.

My friend, Mr. C. M. Barber of the Field Museum of Natural History, recently referred me to Mr. C. C. Adams of the Uni-

* E. D. Cope, Rept. U. S. Natl. Museum 1898, p. 332.

†Strecker, Proc. Biol. Soc. Wash. 1908, p. 72–3.

‡ The Reptile Book, New York, 1907, p. 141.

versity of Chicago for information regarding a female horned lizard that gave birth to young while in captivity. I wrote to Mr. Adams and he sent my letter to A. G. Ruthven, Curator of the Museum of the University of Michigan, who answered it as follows:

"Mr. Adams, of the University of Chicago, has forwarded to me your letter of April 20 in regard to the horned toad. This specimen is in our Museum here. It is a large example of *P. hernandesi* and was taken in the Grand Canon of Colorado, near Bright Angel Trail, on July 10, 1904. It was sent here alive and on July 29, gave birth to 13 young. I am surprised that you find that *P. cornutum* is oviparous. I was under the impression that all the lizards of this genus gave birth to their young alive."

P. cornutum is the only species whose habits I have had an opportunity to study thoroughly, and since the publication of my brief notes on this lizard I have received letters from a number of naturalists who express their surprise to learn of its egg-laying habit. The two sets of eggs mentioned in my notes were described simply to show the difference in the habits of the animal under different circumstances. In both cases the nests were discovered while the females were at work. These sets were merely two out of the dozen or more that have passed through my hands, and in every instance but one the eggs were twenty-four in number. A female, together with her eggs, has been preserved in the University collection for a number of years. The collector, a Baptist minister, informs me that when he first discovered the nest, the lizard was in the act of depositing the eggs and paid no attention to him, although he watched her for several minutes. He then left, and on his return an hour later, found her at work filling up the hole.

The usual site selected for the nesting burrow is the base of a slanting bank of earth or sand. The hole seldom goes straight down, but is usually dug at an angle of about 45 degrees. The animal's fore-feet are used in digging while the hind-feet assist in pushing the earth out of the burrow. As soon as one layer of eggs has been deposited the lizard fills in around and over them with earth and is ready for the next lot. In one nest examined by me, the eggs were arranged in four layers of six each. It is really marvelous how hard and firm the earth is packed into the burrow. The period of incubation is about forty

days, but I presume that this depends largely on the condition of the weather and the location of the nest. Several eggs hatched out in my office on the 35th day, but I am certain that these were several days incubated when they were brought in. In my former notes I mention a set of eggs that were found under an old railroad tie. This seems rather a peculiar case when we consider the fact that the eggs are usually buried to a depth of six or seven inches, but at the time this set was found it had been raining steadily for several days and the ground was wet and soggy. These conditions may account for the seeming neglect of the lizard mother. Had I not captured the female, I might have at first thought that these eggs were those of some other lizard. At that date, however, *Cnemidophorus gularis* was not breeding, in fact had only been active for a very few days, and it is the only other species that would be likely to breed in such a situation. As far as my observations go, none of our other lizards deposit more than a dozen eggs, and there were twenty-four in the set mentioned.

The breeding season extends from the middle of April into the latter part of July. The eggs have a tough, leathery, non-calcareous shell. All of those in one set are usually of the same shape, but when several sets are compared they show considerable variation. The length in about seventy specimens is about the same, but the diameter varies considerably. The average type measures $\frac{5}{8}$ of an inch in length by $\frac{7}{16}$ in diameter. In the fresh egg the color is yellowish-white. Those in the set collected on July 10, 1906, are almost black as they were buried in a bank composed largely of coal dust and cinders.

When first hatched the young are smooth and tender, but in a short time are very active in their movements and fully able to take care of themselves. They do not receive any care from the mother, who probably never returns to the spot where she buries the eggs.

This species, in common with other members of the genus, has the habit of occasionally squirting blood from the corner of the eye. This is only done when the animal has been injured by rough handling. One afternoon I collected twenty-three specimens, and when I was ready to start home my shirt looked as though I had been present at a hog-killing. Judging from my experience I would say that this habit was more common with

our species than with any of the others. An old superstition among the country people and negroes, is to the effect that when a horned toad "spits" blood, its bite is "suah" death.

Some years ago a friend brought me a dead hawk (*Buteo lineatus alleni*) that he had found lying out on the prairie west of the city. It was greatly emaciated and there was considerable dry blood on the feathers of the throat and breast. On skinning it I found no shot wounds, but when I made a careful examination of the carcass I found that it had swallowed two horned lizards and that one of the occipital horns of one of these had penetrated the bird's trachea.

The breeding habits of *Sceloporus spinosus* Wiegmann are subject to considerable variation. I have found five sets of the eggs of this species and a detailed description of the location of each one may not be amiss.

Set A. In a timbered tract where fallen trees were scarce. The four eggs were buried in the hard ground in a level space near the foot of a large oak tree. Depth of hole, 5 inches. When discovered the female had almost finished filling the hole, and was using her fore-feet to press the earth down.

Sets B and C were deposited in small hollows scooped out under the ends of fallen trees. Both hollows were very shallow and the eggs were less than an inch below the surface of the ground. Female lizards present in both cases. Sets of eight eggs each.

Set D (eight eggs) was under the loose bark of a fallen tree, while set E (four eggs) was found in a hollow rotten log.

These sets were all found in districts where no other species of tree lizard occurs. In my experience, I have always found the female *Sceloporus* near her eggs, and I have every reason to believe that she cares for the young for some time after they are hatched.

The female *Cnemidophorus gularis* usually scoops out a shallow hollow in the sand and deposits her eggs to a depth of only an inch or two, but on the grassy flats where there is no sand I have found them buried in the soft earth at the foot of a mesquite tree, to a depth of four or five inches. The eggs of this species are from 8 to 12 in number. The following is a detailed color description of an adult male specimen of *Cnemidophorus gularis* during the breeding season:

Top of head, dark olive green; spaces on sides of head from nostril to eye, light blue. Ground color of back, rich, dark brown; light stripes (with the exception of the two lower ones which are light green) yellowish green; spots in the dark interspaces, buffy yellow. The sides present a barred and mottled appearance as in some examples of *C. tessclatus*, the colors being dark brown and light green. Base of tail, salmon; along median line, olive green; the stripes along the sides of the tail are buff, bordered below by a narrow blue line. Upper surfaces of fore-limbs, blackish brown mottled with buff. Hind-limbs, clove brown marbled with buff. Underside of head and throat, pink. Underparts from throat almost to vent, dark blue. A patch of blue-black between the fore-limbs. A few white scales on the sides of the belly giving it a mottled appearance as seen from the side. A blue line along the inner surfaces of the fore-limbs. Under surfaces of tail and limbs, bluish-white. Total length $10\frac{1}{2}$ in. Length to vent $3\frac{7}{8}$ in., 16 femoral pores. Locality, Waco, Texas.

Ditmars has published an interesting account of the breeding habits of *Eumeces quinquelineatus* L. and I can verify all of his statements excepting in regard to the number of eggs of this species, which he says are 3 or 4. The several sets that I have found were all of 8 eggs each.

Some of our specimens of this species retain the young type of coloration when they are almost full-grown. I have a male specimen with a length of head and body of nearly four inches, that has the usual red head, but the rest of the body is colored as is the "*fasciatus*" type.

While I was working in Burnet County, Texas, two years ago, I collected a number of examples of the rare and interesting short-lined skink (*Eumeces brevilineatus* Cope). In tearing up an old log I found a female of this species and four small oval eggs about 13 mm. in length. I can not be positive that these eggs belonged to this lizard as they were accidently crushed in the collecting can, so that I could not save them to hatch, but I am pretty sure of it, from their resemblance to those of *quinquelineatus*.

The eggs of *Leiolepisma laterale* Say are 3 or 4 in number and are deposited under the bark of fallen trees or in hollow logs. They measure about 9 or 10 mm. in length.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

A SMALL COLLECTION OF ALASKA FISHES.*

BY JOHN TREADWELL NICHOLS.

In the following list are given the species of fishes contained in a small Alaskan collection made in the season of 1907 incidental to the work of the Alaska Salmon Investigations. The collection was made almost entirely by Messrs. M. C. Marsh and J. N. Cobb.

Clupea pallasii.

CALIFORNIA HERRING.

One specimen. Unalaska Harbor, August 5.

Oncorhynchus gorbuscha.

HUMPBACK SALMON.

Ketchikan Cannery.

Oncorhynchus Kisutch.

COHO SALMON.

Specimens from the following localities: Unalaska Harbor; Seward; Ptarmigan Creek, Kenai Peninsula; Juneau Creek, tributary of Kenai River; Cooper Creek (the Cooper Creek referred to here and elsewhere is probably a tributary of Kenai River); Ketchikan Creek; Billy Williams Chuck, George Arm; Chilkoot Lake.

Oncorhynchus nerka.

SOCKEYE SALMON.

Specimens from the following localities: Chilkoot Lake; Yes Bay Cannery; Boca de Quadra; Ketchikan Cannery; Billy Williams Chuck, George Arm.

Salmo sp.

TROUT.

Ptarmigan Creek, Kenai Peninsula; Cooper Creek; Ketchikan Creek; Billy Williams Chuck, George Arm.

* Published by permission of the Commissioner of Fisheries.

Salvelinus malma.
WESTERN CHARR.

Ptarmigan Creek, Kenai Peninsula; Cooper Creek; Bear Creek, near Seward; Juneau Creek, tributary of Kenai River; Chilkoot Lake.

Gasterosteus cataphractus.
ALASKA STICKLEBACK.

Chilkoot Lake; Seward; Bear and Grouse Creeks, Kenai Peninsula.

Anoplopoma fimbria.
BLACK COD.

One specimen, Seward, August 21; two specimens, Seward, August 24.

Hexagrammos octogrammus.
ALASKA GREENLING.

One specimen, Unalaska Harbor, August 5.

Cottus asper.
PRICKLY BLOB.

Head of Chilkoot Lake.

Cottus cognatus.
NORTHERN BLOB.

The collection contains one specimen from Cooper Creek, obtained by Mr. John N. Cobb, which is identified as *Cottus cognatus* Richardson. Careful study shows it to be the same as those referred to this species by Evermann and Goldsborough, 1907.* The specimen has dorsal VIII–16; anal 12; longest ray of pectoral about equal to head, 3.7 in length; ventral 1.6 in head, and 5.2 in length; first dorsal blackish with a whitish tip.

Leptocottus armatus.
SMOOTH CABEZON.

Several small specimens collected by Mr. John N. Cobb from a small pool alongside the Alaska Central Railway, about one mile from the wharf at Seward, Alaska, August 21, show an increased average number of vertical fin rays. Examination of specimens from other points along the coast shows that the fin rays decrease southeastward. The type of the species from San Francisco is distinctly a southern fish, and has D VII–17, A 16. It is then possible to describe a northern race. The point where the line should be drawn between it and the southern one must remain purely a matter of personal opinion, and there seems to be no advantage in recording this interesting geographic variation in nomen-

* Evermann, Barton W. and Goldsborough, Edmund L. The Fishes of Alaska, 1907. Bull. Bur. Fish., XXVI, 307.

clature. The following table from fin-counts of specimens in the collections of the Bureau of Fisheries and of the U. S. National Museum, illustrates its extent:

U. S. Nat. Mus. No.	Locality.	Dorsal.	Anal.
	Seward, Alaska	VII–19	18
	"	VII–19	18
	"	VII–20	18
	"	VIII–19	19
	"	VIII–19	19
	"	VII–20	19
	"	VII–20	20
27976	Port Mulgrave—Yakutat Bay	VII–18	17
27968	Sitka, Alaska	VIII–18	18
6754	"	VII–19	17 or 18
"	"	VII–19	18
"	"	VII–19	19
"	"	VIII–19	19
"	"	IX–20	19
60378	Southeast Alaska—Snug Harbor	VII–18	18
60377	Hunter Bay	VII–18	18
60376	"	VII–20	18
53637	British Columbia—Barclay Sound	VIII–19	18
60380	" Gabriola Island	VIII–19	18
60379	" "	VIII–19	19
34331	Port Townsend, Washington	VII–19	18
	Glenada, Oregon	VII–18	17
	"	VII–18	17
	"	VII–18	17
	"	VII–18	17
	"	VII–18	17
	"	VIII–19?	17
	"	VII–19	1, 17
	"	VII–17	18
	"	VII–19	18
	"	VII or VIII–19	18
	"	VII–20	18
54761	San Diego, California	VII–16	15
"	"	VII–17	15
"	"	VII–17	16
54766	"	VII–17	16

Theragra chalcogramma.

ALASKA POLLOCK.

One specimen from Seward, in August.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NOTES ON GENERA OF PANICEAE. III.*

BY AGNES CHASE.

The grasses in *Paniceae* having two forms of spikelet† form one well-defined group, the *Olyrae*, an outstanding genus, *Amphicarpon*, and a small group of polygamous grasses, *Phyllorachis*, *Thuarea* and *Spinifex*, not closely related to each other nor to any other genera in this tribe. The latter group will be taken up in a later paper. In natural systems these forms have been disposed of in various ways, only the more important of which are here considered, as the history of the classification of this tribe will be taken up later.

Beauvois'‡ disposition of these forms is interesting since his is the first attempt at a systematic arrangement of all the known genera of Gramineae into divisions and subdivisions. His confidence in the enduring excellence of his Méthode, however much the rest of the Essai might fall short of perfection, is also interesting.§ He places these forms in "Familia II. Polythalama. Locustae dissimiles;" "Tribus quarta, axis integer. Glumae alternatim insertae," [as distinguished from tribe III *Tripsacum*, etc.]. *Olyra* comes under "Cohors Octava. Axes androgyni" with *Zizania* and *Pharus*, while *Lithachne* comes under "Cohors Nona. Axes monoici aut dioici. Sectio Prima. Axes monoici"

* Notes on Paniceae I appeared in Proc. Biol. Soc. Wash. 19: 183-192. Dec. 1906; Notes on Paniceae II op. cit. 21: 1-10. Jan. 1908.

† The text figures in the present paper are all magnified 5 diameters only, as most of the fruits in this group are unusually large.

‡ Agros. tab. meth. and pp. 124, 135, 137; 1812.

§ Les changements qu'on pourra y faire par la suite, pourront porter sur quelques details, sur des reunions ou des separations de genres; mais je ne pense pas qu'ils puissent attaquer en rien les bases et les principes de la Méthode. Les genres y sont tous distingues par des caracteres certains, constants et facile a saisir." Op. cit. Avertissement.

together with *Hydrochloa*, *Zea* and *Coix*, while *Spinifex* comes in "Sectio secunda. Axes dioici" with *Gynerium*.

Humboldt, Bonpland and Kunth (1815, Nov. Gen. 1:196) propose a "Section IX Olyraceae" which includes *Pharus*, *Olyra* and *Luziola*. [*Paniceae* is their Section I.] Kunth (1815, Mem. Mus. Hist. Nat. 2:75) proposes a group "Gramina Olyrea" which includes *Zizania*, *Luziola*, *Hydrochloa*, *Pharus*, *Olyra*, *Zea*, and *Coix*.

Trinius (1826, Gram. Pan. 53, 55, 247, 249), places *Olyra* and *Milium amphicarpon* in his "Paniceorum Genera."

Nees (1829, Agros. Bras. 298) establishes "Familia Secunda. Gramineae Olyreae" for *Strephium*, *Caryochloa*, *Luziola*, *Pharus*, *Olyra* and *Coix* (Family 1 is *Paniceae*).

Kunth (1833, Enum. Pl. 67–70, 174) places *Amphicarpum*, *Olyreae* and *Spinifex* in "III Paniceae" which is very nearly the tribe *Paniceae* as recognized to-day, and subsequent authors generally have followed this disposition of these forms, though often associating *Pharus* and allied genera with them under *Paniceae*.

Though the *Olyrae* and *Spinifex* depart rather widely from the *Panicum* type, their affinities are clearly with this tribe. *Lithachne* Beauv. forms the only known exception to the tribal character of fruit dorsally compressed or subcompressed.

OLYREAE: Plants monoecious; blades flat, abruptly narrowed into a petiole-like base, convolute in the bud, the consequent creases persistent in the mature blade. First glume wanting in the pistillate spikelets, both glumes and sterile lemma wanting in the staminate spikelets.

KEY.

Inflorescence borne on leafy culms; fruit bony-indurated:	
Panicles terminal on culms or leafy branches, pistillate spikelets above, staminate spikelets below, in same panicle	*Olyra*
Panicles all axillary or axillary and terminal; the terminal when present wholly staminate:	
Fruit laterally compressed, conspicuously gibbous on upper dorsum	*Lithachne*
Fruit dorsally compressed, lanceolate	*Raddia*
Inflorescence consisting of 2 slender racemes, one staminate, the other pistillate, digitate at the summit of a naked culm; leafy stems distinct from base; fruit scarcely indurated	*Mniochloa*

Genus OLYRA L. May, June, 1759, Syst. Nat. ed. 10. 1261.

"Masc. Cal. Gluma uniflora, aristata, Cor. Gluma mutica.

"Fem. Cal. Gluma uniflora, patula, ovata. Stylus 2-fidus. Sem. cartilagineum.

"*latifolia* A. Olyra. Sloan. jam. t. 64. f. 2."

The figure referred to in Sloane represents the upper portion of a culm with three leaves and a short exserted panicle, large spikelets on clavate pedicels at the ends of the branches and small spikelets along the same branches from the base. The polynomial given is "Gramen paniceum majus, spica simplici laevi, granis petriolis insidentibus."

The type, from which the figure was made, is in the Sloane herbarium. The specimen in the Linnaean herbarium, from Jamaica, marked "Br" [Browne] agrees with the Sloane specimen. In Pugill. Jam. Pl. 408. Dec. 1759, Linnaeus gives a description of the species *O. latifolia*.

Mapira Adans. 1763, Fam. 2 : 39.

"Couronne de la gaîne des feuilles: Membrane courte. Fleurs: Panicule & épi. Calice: 1 fleur, 2 bales & 1 arête. Corolle: 2 bales."

In the "table" or index, page 574, under "Mapira Adans 39" is cited "Gramen. Sloan. t. 64. f. 2. Olyra. Lin." This is the figure upon which Linnaeus bases *Olyra latifolia*.

Description.—Spikelets unisexual, unlike in appearance, the staminate and pistillate together in panicles terminating the culm or leafy branches, the pistillate spikelets on clavate pedicels on the upper panicle branches or at the ends of the branches, the staminate spikelets on slender pedicels or subsessile on the lower branches or on the lower part of the pistillate branches; pistillate spikelets ovate-lanceolate, usually setaceous pointed, first glume wanting, second glume and sterile lemma membranaceous, nerved, acuminate-setaceous (or long-acuminate only in *O. longifolia* H. B. K.), the glume longer pointed than the lemma; fruit elliptic, lemma and palea thick, bony-indurated at maturity, the margins of the lemma scarcely inrolled; grain dorsally subcompressed, enclosed in the lemma and palea; staminate spikelets readily deciduous, much smaller than the pistillate, narrowly lanceolate, glumes and sterile lemma wanting, lemma and palea thin membranaceous, the lemma 3-, the palea 2-nerved. Woody, bamboo-like perennials with ample blades abruptly narrowed into petiole-like bases, convolute in the bud before expanding, the consequent creases permanent and conspicuous in the mature blades. Species about twenty, confined to the tropics and subtropics of America except a form of *O. latifolia* L. or a close ally which is found in South Africa, and a form distantly related to *O. micrantha* H. B. K. in the Fiji Islands.

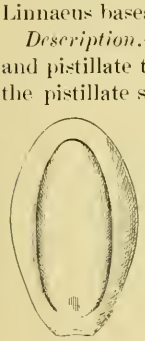

Fig. 1.
Olyra latifolia.

The known species fall into three rather well-marked groups.

1. *Panicle branches with elliptical or lanceolate, setaceous-pointed, pistillate spikelets above, staminate spikelets below ; glumes glabrous or nearly so.*

* *Fruit smooth and shining, not pitted.*

Olyra latifolia L., capillata Trin., caudata Trin., cordifolia H. B. K., pubescens Radd., scabra Nees.

** *Fruit not pitted, clothed with thick silky hairs at base and summit, on margins or back.*

Olyra glaberrima Radd., ciliatifolia Radd., semiovata Trin., and the following:

Olyra yucatana

Panicles contracted, often a second one from the upper sheath, 8–15 cm. long, 2 cm. wide, axis and rachis scabrous; staminate spikelets on the lower branches and lower part of upper pistillate branches, 8 mm. long including the setaceous tip of the lemma, palea about 2 mm. shorter; pistillate spikelets 15 to 17 mm. long, the glume and sterile lemma scabrous, 7-nerved, 8 mm. long, and acuminate into flexuous setaceous tips as long again in the glume, half as long in the sterile lemma; fruit elliptical, obscurely pointed, 7 mm. long, 4 mm. wide, white and shining or old ivory toward maturity, the lemma silky-pubescent at base and on the margins. Culms tall, slender; sheaths mostly longer than the internodes, crisp-puberulent, blades 13 to 16 cm. long, one-third as wide, abruptly acuminate at the apex, trapezoid-truncate at base. Known only from Yucatan.

This species was described and figured by Millspaugh & Chase (1903, Field Col. Mus. Bot. 3 : 46) under the name *Olyra semiovata* Trin. The examination of Trinius' type has shown this disposition of the Yucatan form to be erroneous. Type *Gaumer* 2372, No. 125941 Herb. Field Columbian Museum. "Common at Chichankanab, *Gaumer* 1389, Pocoboch, *Gaumer* 2372."

*** *Fruits pitted.*

Olyra fasciculata Trin., filiformis Trin., heliconia Lindm. (Pl. Boliviana, a Miguel Bang lectae no. 508, distributed as *O. latifolia* belongs to the latter species.)

2. *Upper panicle branches with globose, hispid-bristly, setaceous-pointed, pistillate spikelets only; lower branches with staminate spikelets only; fruit pitted.*

Olyra micrantha H. B. K., hirsuta Trin., ventricosa Nees. A specimen from "Feejee Islands, Sandalwood Bay" collected on the Wilkes expedition 1838–42 belongs in this group.

3. *Upper panicle branches with oval pistillate spikelets, not pointed, fruit smooth.*

Olyra ramosissima Trin., Panicum laterale Presl and probably O. sarmentosa Doell, form a third group with unpointed pistillate spikelets on pedicels scarcely clavate, glabrous and unpitted fruit; slender-stemmed freely branching plants with blades and panicles scarcely exceeding 5 cm. long.

In *O. ramosissima* the staminate spikelets are villous and only on the lower branches of the panicles. Our specimens of *P. laterale* Presl (*Pittier* 3641, 11008, 12058) are destitute of staminate spikelets, but the pistillate spikelets with the first glume wanting, bony-indurated fruit and no stamens, as well as the firm blades abruptly narrowed into a petiole-like base unmistakably place this species in *Olyra*.

Olyra laterale (Presl).

Panicum laterale Presl 1830. Rel. Haenk. 1 : 305. "Hab. in Peruviae montanis huanoccensibus." The type, in the Presl herbarium in the National Museum at Prag, is labeled "Panicum laterale nov. sp. J. S. Presl" and "Peruano montano oronocciensis." No staminate spikelets are present, the first glume is wanting in the pistillate spikelets, though Presl's description reads: "gluma inferiore brevissima," and again "Gluma inferior minima vix ulla." Judging from the description *O. sarmentosa* Doell is this species or closely allied to it.

Genus LITHACHNE Beauv. 1812, Agros. 135, t. 24, f. 11.

"De λιθος, Lapis; ἄχνη, Palea.

"Culmus ramosus: Axes spicati: Spicae simplices, dissimiles; alia terminali, Locustis 1-floris, masculis.—Glumae nullae.—Paleae acutissimae.—Stamina 6; aliis axillaribus, Locustis 1-floris, semineis.—*Glumae herbaceae*, acutissimae.—Paleae *coriaceo-induratae:* infer. *truncata, naviculari, gibba.* * * * Spec. Olyra *pauciflora* Lin." [error for Swartz, in the index (p. 168) "Olyra pauciflora Sw. Vid. Lithachne 135" is given.]

Beauvois' statement that there are six stamens is an error, due probably to mistaking the separated cells for entire anthers.

Though the genus is based on *O. pauciflora* Sw. Beauvois does not transfer this name to his new genus; in the index (p. 166) the only species given under *Lithachne* is *axillaris* without reference as to what this name is based on. In the explanation of plate 24 the name *Lithachne axillaris* is used. *Olyra axillaris* Lam. 1797 Encyc. 4 : 547 (see below), is the same species as *O. pauciflora* Sw. and Lamarck cites the latter name as a synonym under his own *O. axillaris* though published some years earlier. Beauvois does not cite Lamarck's work though he must have been acquainted with it and his *L. axillaris* is doubtless based on Lamarck's *O. axillaris*.

Olyra pauciflora Sw. 1788, Prod. 21. "Jamaica." The type labeled "*Olyra pauciflora* Sw. fl. ind. occid. Jamaica Sw." is in the Swartz herbarium at Stockholm.

Trinius (1820, Fund. Agros. 200) includes *Lithachne* under *Olyra*, "panicled, or spikelets axillary" covering both in the diagnosis; the gibbous pistillate floret is not mentioned. In 1826 (Gram. Pan. 251) Trinius makes the same disposition of *Lithachne;* the gibbous character of the floret being mentioned as: "perianthio semiovato, truncato."

Poiret (1823, Dict. Sci. Nat. 27 : 60.) with the spelling "*Lithacne*" gives a brief description of the genus and species, transferring *O. pauciflora* Sw. to this genus, but giving Beauvois as author of the combination.

Sprengel (1825, Syst. 1 : 238.) includes *O. pauciflora* Sw. in *Olyra* giving *Lithachne* as synonym.

Nees (1829, Agros. Bras. 309) in a note after *Olyra floribunda* Radd. says that this species, which he inserts on the authority of Raddi not having seen it, is to be referred to *Lithachne* Beauv. with *Olyra pauciflora* Sw. The latter is not included in his Agrostologia Brasiliensis.

Kunth (1829, Rev. Gram. 1 : 29 and 1833, Enum. 1 : 68) places *O. pauciflora* Sw. in *Olyra* without mentioning the gibbous floret in either the generic or specific description, though the axillary panicles are noted. *Strephium* Schrad. is given generic rank in the Emmeratio (p. 70) emphasis being given to "Culmi caespitosi. Folia disticha. Racemi axillares, pauciflori" which would apply as well to *O. pauciflora* Sw.

Trinius (1835, Pan. Gen. 30)* places *O. pauciflora* Sw. together with *O. floribunda* Radd. and *O. polypodioides* Trin. in *Olyra* under "b) Spiculae femineae in racemis propriis, inferis vel paniculae masculae subjectis (Lithachne P. B.)." The gibbous fruit of *O. pauciflora* is noted.

Steudel (1854, Syn. Pl. Glum. 1 : 37) includes *Olyra pauciflora* Sw. as well as *O. floribunda* Radd. and *O. polypodioides* Trin. in *Olyra*, copying Trinius' synoptical heading given above. The gibbous floret of *O. pauciflora* Sw. is not mentioned.

Grisebach (1864, Fl. Brit. W. Ind. 536) includes *O. pauciflora* Sw. under *Olyra;* the pistillate "flower obversely deltoid," is mentioned. In 1866 (Cat. Pl. Cub. 229) Grisebach makes the same disposition of it and includes *O. pineti* Wright and *O. strephioides* Griseb. also.

Fournier (1876, Bull. Soc. Bot. Belg. 15: 464, 465) in a paper "Sur les Graminées mexicaines à sexes séparés," distinguishes between *Olrya*, *Lithachne* and *Strephium* but makes some errors in detail. Of *Lithachne* he says the male spikelets are superior and the female inferior which serves to distinguish it from *Olyra;* and again, that *Lithachne axillaris* Beauv. (*O. pauciflora* Sw.) establishes a transition from *Lithachne* to *Strephium*, that the inferior axillary branches are reduced to a single flower, but these [pistillate spikelets] still form part of the same terminal panicle as the males, that this species further differs from *Strephium* in the bellied or swollen female floret. Of *Strephium* he says that the male and female spikelets are in different inflorescences. But some of these distinctions do not hold good in all cases and some are wholly in error. In *O. pauciflora* the axillary panicles bear one to several staminate spikelets below the terminal pistillate one; again we find no specimens in which pistillate spikelets are truly in the terminal panicle, but they sometimes appear to be so since the upper blades are crowded at the summit of the culm and their respective axillary inflorescences overlap the terminal one, which, so far as our specimens show, is entirely staminate when present, but it is often wanting. As for *Strephium* while the staminate and pistillate spikelets are almost constantly in distinct racemes we find staminate spikelets (or their characteristic slender pedicels as distinguished from the clavate pedicels of the pistillate spikelets) below the pistillate spikelets in the

* Mem. Acad. Petersb. Ser. VI, 3 : 2118. 1835.

narrow axillary panicles of a Liebmann specimen of *S. strictiflorum* Fourn. cited by Fournier in his original description.

Doell (1877 in Mart. Fl. Bras. 2: [2] 315) includes all these forms in *Olyra*, dividing the genus into "I. Aerandrogynae. Panicula terminalis, nonnunquam cum una alterave panicula accessoria laterali. Spiculae utrisque sexus in eadem panicula, femineae pauciores." [It should be noted that the lateral panicles of this group are terminal on leafy branches not axillary as in II and III.] This includes *O. latifolia* L. and fourteen other species several of which we have not seen, but all (except *O. sympodica* Doell) apparently coming within the genus *Olyra* as limited above. "II Pleurandrogynae. Paniculae laterales, basi masculae, apice femineae (suprema rarius terminalis et mere mascula.)" This includes O. *flaccida* Doell, which we have not seen, and *O. pauciflora* Sw. "III. Heterogenicae. Paniculae sexu distinctae, monoecae, inferiores mere femineae, nonnunquam ad spiculam unicam redactae, superiores masculae. Panicula terminalis, ubi adest et ipsa mascula." A footnote is added here saying that these characters are those of the genus *Strephium* which in his opinion has too little to distinguish it. Under this division are *O. polypodioides* Trin., *O. floribunda* Radd., and *O. nana* Doell; *O. pineti* Wright is added at the end with the observation that this Cuban species also belongs in this section of the genus. In the description of the latter the gibbous pistillate floret is noted.

Fournier (1881, Mex. Pl. 2: 4) recognizes both *Lithachne* and *Strephium* as genera, but he gives no generic description and the key is inaccurate as regards position of pistillate spikelets in the latter two. (See above under Fournier, 1876.) *Lithachne* and *Strephium* are divided on the gibbous floret of the first and linear-elliptic floret of the second.

Bentham & Hooker (1883, Gen. Pl. 3: 1110) include all these forms in *Olyra*, remarking that *Lithachne*, *Strephium* and *Raddia* form a section with axillary few-flowered pistillate or androgynous panicles.

Hemsley (1885, Biol. Cent. Am. 3: 510) includes all under *Olyra*, transferring Fournier's *Strephium strictiflorum* to *Olyra*.

Hackel (1887, Engler & Prantl, Pfl. Fam. 2: [2]39) includes *Lithachne*, *Strephium* and *Raddia* as synonyms under *Olyra* without subdivisions or sections.

Description.—Spikelets unisexual, unlike in appearance; inflorescence consisting of few to several small panicles or racemes, solitary or in fascicles of two to four or five, short-exserted from the sheaths, each bearing one pistillate spikelet on a clavate pedicel at the summit, and one to several staminate spikelets on slender pedicels, below; a narrow short-exserted terminal, wholly staminate panicle often present, rarely a fascicle of 2 or 3 such panicles; pistillate spikelets V-shaped owing to the greatly swollen fertile lemma; first glume wanting; second glume and sterile lemma membranaceous, nerved, unequal, long-acuminate; fruit laterally subcompressed (forming an exception to the tribe character of dorsally compressed fruit in *Paniceae*), lemma and palea thick bony-indurated, the lemma greatly

Fig. 2. *Lithachne pauciflora.*

swollen or gibbous on the back, so as to appear in side view half obcordate-truncate, the margins inrolled over a narrow palea; grain laterally subcompressed, inclosed in the lemma and palea. Staminate spikelets narrowly lanceolate, reduced to the thin-membranaceous lemma and palea and 3 stamens. Caespitose, herbaceous, perennials with simple culms and blades contracted at base and convolute in the bud as in *Olyra*. Only two species known to us (*O. flaccida* Doell may belong here), confined to the tropics and subtropics of America.

While neither the laterally-compressed gibbous fruit nor the axillary inflorescence alone would afford sufficient reason for recognizing *Lithachne* as a genus, these being combined and constant, together with a habit distinct from that of *Olyra*, and the fact that there are no intermediate species (so far as known), seem to make generic rank the more natural disposition of these forms.

Lithachne pauciflora (Sw.) Beauv.

Olyra pauciflora Sw. 1788, Prod. 21. (See above.)

Olyra axillaris Lam. 1797. Encyc. 4 : 547. "a Caienne * * * Richard (V. s)" "Lam. illust. t. 751 f. 2," is cited. The published date of the part in which this plate occurs is 1823, but according to Sherborn and Woodward * plates 1–100 were published in 1791; 700 in 1797; 901–950 in 1819. Evidently some of the plates were printed some time before they were issued. We have not seen the type but the plate referred to above is unmistakable.

Lithachne axillaris Beauv. 1812, Agros. 166 t. 24, f. 11. No type indicated, presumably based on *Olyra axillaris* Lam.

Lithacne pauciflora Beauv.; 1823, Poir. Dict. Sci. Nat. 27 : 60. Two varieties of this species have been described by Kuntze (Rev. Gen. 3 : 357) from Bolivia.

Lithachne pineti (Wright).

Olyra pineti Wright 1862; Griseb. Mem. Acad. Amer. Sci. Art. 8 : 532. "Prope Monte Verde, inter pinorum folia dejecta 1536" [Wright, Cuba]. The type is in the Grisebach herbarium; a duplicate in the Gray herbarium is a tuft of numerous very slender culms. Besides the label the latter sheet bears a slip in Wright's hand "Olyra Pineti. Growing among masses of fallen pine leaves near Mr. Prevals, M. V., [Monte Verde] Aug. 22."

A delicate species apparently known only from the Wright collection.

Genus RADDIA Bertol. 1819, Bologn. Opusc. Sc. 3 : 410.

"Flores masculi in racemis distinctis, superioribus. Calyx unifloris, biglumis, glumis acuminatis, muticis. Corolla nulla. Filamenta brevissima. Antherae lineares longae.

"Flores foeminei in spicis distinctis, inferioribus. Calyx unifloris biglumis, patens, gluma altera longiore, aristata. Corolla biglumis, mutica, stylus simplicissimus."

* Ann. Mag. Nat. Hist. 17 : 582, 1906.

But one species is given:

"*Raddia Brasiliensis.*

"Habitat in provincia di Rio Janeiro Brasiliae, v. s."

The specimen was collected by Raddi since Bertoloni states that the specific name will commemorate the courageous voyage to Brazil of Raddi to whom the genus is dedicated. The author remarks that this genus serves to unite *Coix* with *Olyra*.

The whereabouts of Bertoloni's type, if it be in existence, is not known. In the Trinius herbarium is a specimen from Bahia, Brazil, collected by Riedel, labeled *Olyra floribunda* Raddi by Trinius, and the original of plate 345 in the Icones which agrees well with Bertoloni's description.

Raddi (1823, Agros. Bras. 20) redescribes what is evidently a specimen from the same collection under the name "*Olyra floribunda* * * * nob" and gives *Raddia brasiliensis* Bert. as a synonym. "Reperitur ad radicem Montis Corcovado, nec alibi." [Mt. Corcovado is some three miles southwest of Rio Janeiro.] Raddi's type has not been examined. Nees says that nothing but the description remains, but search among Raddi's Brasilian collections in the herbarium of the botanical garden of Pisa may bring it to light. The two descriptions apply so well to Trinius' specimen that there is no doubt that this species was correctly interpreted by Trinius.

Sprengel (1827, Syst. 4: Cur. Post. 29) transfers *R. brasiliensis* Bertol. to *Olyra* without comment.

Nees (1829, Agros. Bras. 309) includes *O. floribunda* in *Olyra* with the following observation: "De hac specie, ad Lithachnas, Pal. de Beauv., cum Olyra pauciflora Sw. referenda, praeter verba Raddiana nihil superest, quod ad feramus." The description states that the pistillate spikelets are in distinct axillary racemes, but does not mention the form of the floret.

Strephium Schrad. 1829, in Nees Agros. Bras. 298.

"Spiculae uniflorae, muticae; masculae et foemineae in distinctis racemis ejusdem plantae. Spiculae masculae: calycis glumae duae, lineari-lanceolatae; inferior acuminata; corollinae valvulae nullae. Foeminaea spiculae: calycinae glumae duae, ovato-lanceolatae, acuminatae; valvulae totidem, cartilagineae. * * * Inflorescentia: Racemi, axillares, pauciflori. Culmi caespitosi, foliis subdistichis.

"Observ. Genus hocce Olyrae proximum, sed diversum foliatione, spicularum dispositione axillari, floribus masculis superius positis atque glumarum structura et proportione. Schrad."

This is based on a single species, *Strephium distichophyllum* "Schrad. ined." We have not seen the type of this, but the description applies so well to *Olyra polypodioides* Trin. that it must be a close ally of that species (the type of which, also from Bahia, Brazil, was examined in the Trinius herbarium at the St. Petersburg Academy of Sciences), as stated by Trinius (1835, Mem. Acad. Petersb. Ser. VI, 3: [2]117). Nees' description of *Olyra floribunda* Raddi (l. c.) would place this species in *Strephium* instead of in *Olyra*, but he had not seen *O. floribunda* and possibly Schrader's genus and species were inserted on Schrader's authority only without

having been seen by Nees. Trinius' specimen of *O. floribunda* is closely related to *Strephium strictiflorum* Fourn., though much smaller in all its parts, but these are closely congeneric with *O. polypodioides*. This is well brought out in the detailed drawings of *O. polypodioides* and *O. floribunda* in plate 45, Doell in Mart. Fl. Bras. vol. 2, pt. 2.

Kunth (1833, Enum. 1:70) recognizes *Strephium* as a genus (see note under *Lithachne*.)

Trinius (1835, Pan. Gen. 29)* places *O. floribunda* Radd. and a new species, *O. polypodioides* Trin. in *Olyra* (see note above under *Lithachne*) and in the Icones (1836, pl. 345) the former is figured.

Steudel (1854, Syn. Pl. Glum. 1:36) includes these forms in *Olyra* (see note above under *Lithachne*).

Wright (1871, Anal. Acad. Cien. Habana 8:202; 1873, Sauv. Fl. Cub. 193) transfers *Digitaria pulchella* Griseb. to *Strephium* with the mark of doubt.

For the disposition of these forms by Fournier (1876, Bull. Soc. Bot. Belg. 15:465; and 1881, Mex. Pl. 2:4); Doell (1877, Mart. Fl. Bras. 2:[2]315); Bentham & Hooker (1883, Gen. Pl. 3:1110); Hemsley (1885, Biol. Cent. Am. 3:510), and Hackel (1887, Engler & Prantl, Pfl. Fam. 2:[2]39) see notes above under *Lithachne*.

Description.—Spikelets unisexual, unlike in appearance; the staminate and pistillate in distinct small panicles, the staminate terminal or from the upper nodes; the pistillate axillary, short-exserted, few-flowered, usually from the lower nodes (a few staminate spikelets sometimes borne below the pistillate spikelets in *Strephium strictiflorum*); pistillate spikelets lanceolate, first glume wanting, second glume and sterile lemma membranaceous, strongly nerved, subequal, acuminate; fruit dorsally subcompressed, lanceolate, acute; lemma and palea bony-indurated but less so than in *Olyra* and *Lithachne*, the margins flat, nearly meeting over the palea. Staminate spikelets linear-lanceolate. Low caespitose herbaceous perennials with simple culms and blades narrowed at the base, the creases indistinct, usually conspicuously distichous and turned with the surfaces on a single plane. Five known species, natives of the tropics and subtropics of America.

Fig. 3. *Raddia polypodioides.*

RADDIA BRASILIENSIS Bertol. 1819, Bologn. Opusc. Sc. 3 : 410.

Olyra floribunda Radd. 1823, Agros. Bras. (See above.)

Olyra brasiliensis Spreng. 1827, Syst. 4: Cur. Post. 29, based on *Raddia brasiliensis* Bertol.

Strephium floribundum Nees 1854; Steud. Syn. Pl. Glum. 1 : 36, based on *Olyra floribunda* Radd.

Raddia distichophylla (Schrad.).

Strephium distichophyllum Schrad. 1829, in Nees Agros. Bras. 298. "Habitat in sylvis primaevis, prov. Bahiensis ad viam Felisberti alibique."

* Mem. Acad. Petersb. Ser. VI, 3:[2]117.

Raddia polypodioides (Trin.).

Olyra polypodioides Trin. 1835, Mem. Acad. Petersb. Ser. VI. 3 : 2117. "V spp. Bahiens."

Raddia strictiflora (Fourn.).

Strephium strictiflorum Fourn. 1876, Bull. Soc. Bot. Belg. 15 : 465. "Arroyo Sellero (Karw.[insky] n. 1473 in herb. Petropolitano)."

Olyra strictiflora Hemsl. 1885, Biol. Cent. Am. Bot. 3 : 510; based on the preceding.

Raddia nana (Doell).

Olyra nana Doell 1877, in Mart. Fl. Bras. 2 : 2329. "Ad Ega prov. do alto amazonas (Martius)." The type is in the herbarium of the Botanisches Museum at Munich.

Raddia concinna (Hook, f.).

Olyra concinna Hook f. 1896, Bot. Mag. III, 52 : t. 7469. "*O. concinna* arrived at the Royal Gardens, Kew, in 1891 * * * sent by Mr. C. Winkle, from San Jose in Costa Rica. It flowered in January, 1895."

Olyra sympodica Doell, 1877 in Mart. Fl. Bras. 2 : 2322 probably belongs in this group as suggested by Doell (op. cit. p. 329). It seems likely that the "sympodium" he describes is not truly a sympodium but that the culms simulate this habit by a twisting of the internodes, as not infrequently occurs in this genus and in *Lithachne*.

Genus MNIOCHLOA gen. nov.

Inflorescentia monoica, racemis binis tenuibus spiciformibus, alter staminato alter pistillato, summo apici culmi nudi insidentibus constans. Spiculae pistillatae 1-florae, oblongo-lanceolatae dorsaliter compressae, solitariis brevissime clavellato-pedicellatae, secus rhachim triangularem tenuem unilateraliter dispositae; gluma prima nulla, gluma secunda lemmati sterili aequans, setis nullis; lemma fertile albo cartilaginiter subindurato, marginibus planis, paleam similem amplectens; caryopsis dorsaliter compressa; staminum rudimentis nullis. Spiculae staminatae pistillatis breviores, glumis lemmatique sterili nullis; lemmati paleaque membranaceis; lemmati 1-nervo, palea 2-nervo, staminibus 3. Gramina perennia humilia caespitosa. Culmi fertiles 1-3-nodi, vaginis brevibus laminis carentibus instructi. Culmi steriles crebre, et plerumque duplici ordine foliosi; laminis planis, 2 cm. longis aut minoribus, ovato-lanceolatis, basi abrupte contractis et quasi brevi petiolatis. Trahit nomen a μνίον *musco* et χλόα *gramine* pro stirpium sterilium similitudine *Mnii* generis cuiusdam musci.

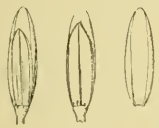

Fig. 4. *Mniochloa pulchella.*

Typus.—*Digitaria pulchella* Griseb.

Inflorescence monoecious consisting of two slender spike-like racemes, one pistillate the other staminate, at the summit of a slender naked culm; pistillate spikelets dorsally compressed, 1-flowered, lanceolate-oblong, solitary on very short clavate pedicels along one side of a slender triangular rachis; first glume wanting, second glume and sterile lemma subequal, not setaceous; fertile lemma white-cartilaginous subindurated, the margins flat, enfolding a palea of like texture and equal length; grain dorsally compressed; staminate spikelets smaller than the pistillate, glumes and sterile lemma wanting, lemma and palea membranaceous, equal, the lemma 1-nerved, palea 2-nerved; stamens 3. Low tufted perennials; the flowering culms with 1 to 3 nodes, the short sheaths destitute of blades, distinct from the sterile stems which bear several to many more or less distichous, flat, ovate-lanceolate, blades, less than 2 cm. long, narrowed into a petiole-like base. Name from μνίον moss and χλόα *grass*, from the resemblance of the sterile stems to *Mnium* a genus of mosses. But two species known, both from Cuba.

Type.—Digitaria pulchella Griseb.

Mniochloa pulchella (Griseb.).

Digitaria pulchella Griseb. 1866, Cat. Pl. Cub. 231. "Cuba or. (Wr[ight] 3448). E[ndemic]." The type in the Grisebach herbarium at Göttingen was examined by Prof. A. S. Hitchcock.

Strephium? pulchellum Wright 1871, Anal. Acad. Cien. Habana 8 : 202; Sauv. Fl. Cub. 193. 1873. "[3448.] *Digitaria pulchella* Gris. Crece al borde de precipicios en el Yunque de Baracoa."

A description follows giving the monoecious character of the inflorescence, a point which seems to have escaped Grisebach's notice.

A delicate species, flowering culms filiform, 15 to 25 cm. high, nodes 2 or 3, at least the lower geniculate, the upper internode and peduncle elongated, sheaths slightly inflated, 1 to 3 cm. long, racemes erect or ascending 2 to 3.5 cm. long, the staminate slightly shorter than the pistillate; pistillate spikelets glabrous, 2.5 mm. long; glume and sterile lemma about one-fourth shorter than the glabrous fruit; staminate spikelets 1.5 mm. long, glabrous. Sterile stems spreading or prostrate, the distichous leaves approximate, the sheaths, at least the upper overlapping, ciliate on the margin and at the summit, blades firm, 8 to 18 mm. long, 3 to 5 mm. wide, subacute, sparsely hairy along the midnerve, pale green above, dark purplish beneath, undulate on the margins. Known from a single collection, *Wright* 3448. In addition to the type, specimens of this number have been examined in the Gray herbarium and in the Sauvalle herbarium in the Estacion Agronomica, Santiago de las Vegas, Cuba. The specimen in the Gray herbarium has five flowering culms from the single small tuft. On the sheet is a slip in Wright's hand "Gram. near Olyra * * not Digitaria, *nor.* Panicum."

Mniochloa strephioides (Griseb.).

Olyra strephioides Griseb. 1866, Cat. Pl. Cub. 229. "Cuba occ. (Wr[ight] 3435)." Type in the Grisebach herbarium at Göttingen.

Muhlenbergia pulchella (Griseb.) Chase.

Plant, natural size. Staminate spikelet, two views of pistillate spikelet and fruit magnified 10 diameters.

Grisebach's description is inaccurate in regard to the inflorescence, which he describes as staminate and pistillate mixed, terminal pistillate. The staminate and pistillate racemes are distinct in the type as in the other specimens seen, but the two lie so closely together that they might be mistaken for one unless examined carefully.

Flowering culms slender 4 to 7 cm. high, equaling or shorter than the sterile stems, the inflorescence short-exserted, the racemes erect, 1 to 3 cm. long, about equal; pistillate spikelets 3.5 mm. long, the glume and sterile lemma glabrous, exceeding the fruit which is entirely clothed with white silky hairs; staminate spikelets scarcely one-half as long as the pistillate, glabrous. The sterile stems less delicate than in the preceding, blades firmer, pale green, triangular ovate, minutely pubescent on both surfaces, ciliate on the margins. Besides the type, specimens of *Wright* 3435 have been examined in the National Herbarium, Gray herbarium, herbarium of Columbia University, and in the Sauvalle herbarium. This species was collected by Caldwell and Baker (no. 7011) at San Diego de los Banos, Cuba, the only known collection since Wright's.

Genus AMPHICARPON, Raf. Jan. 1818, Am. Month. Mag. 2 : 175.

"His [Pursh's] Milium amphicarpon must probably form a new genus Amphicarpon Raf." The foregoing occurs in Rafinesque's review of Pursh's Flora of North America. No generic characters are given and it is evident Rafinesque had not seen the species upon which he bases his genus, but technically the above constitutes publication.

Milium amphicarpon Pursh 1814, Fl. 1 : 62. pl. 2. "New Jersey near Egg-Harbour." The plate represents a specimen with a narrow terminal panicle and numerous large spikelets on slender branches from the base of the culm. The type is in the herbarium at Kew. The name "Milium Amphicarpum" and "Herb. Pursh propr" are written on the sheet, and on the back is written "N. America, Fred. Pursh."

Pursh gives a good description of "this singular grass" but his statement: "Flores feminei in scapis radicalibus unifloris basi vaginatis," is inaccurate in that these spikelets are perfect and cleistogamous.

Amphicarpum Kunth 1829, Rev. Gram. 1 : 28.

"Spiculae biflorae (flore inferiore unipaleaceo, neutro glumae simillimo), masculae et femineae in eadem planta; hae radicales, longe pedunculatae; illae terminales, paniculatae.

"Masc.: Gluma unica (altera inferior nulla), membranacea, concava, mutica. Paleae floris masculi duae, longitudine glumae, subaequales, chartaceae, concavae, muticae; inferior superiorem binerviam amplectens. * * * Stamina tria. Ovarium effetum. Fem: Gluma unica, membranacea, multinervea, concava, mutica, paleis vix brevior. Paleae floris feminei duae coriaceae, acutatae; inferior superiorem binerviam amplectens. * * * Stamina effeta. Ovarium glabrum. Stigmata duo, terminalia, sub-sessilia, plumosa; * * * Caryopsis oblonga, teretiuscula, glabra, libera, paleis inclusa. Gramen caespitosum. * * * Panicula ramis simplicibus; spiculis pedicellatis, racemosis, cum pedicello con-

tinuis. Pedunculi seminei fasciculati, uniflori, vaginati; fructiferi subterranei."

But one species is given:

"*Amphicarpum Purshii.* (Milium amphicarpum Pursh. * * *)"

Although Kunth bestows upon this genus the same name as did Rafinesque, it does not appear that he knew of the latter's proposed genus.

Like Pursh in the original description of this species, Kunth errs in saying that the subterranean spikelets are pistillate only, and in this is followed by Steudel (1854, Syn. Pl. Glum. 1 : 35) and Bentham & Hooker, (1883, Gen. Pl. 3 : 1099). Trinius (1821, in Sprengel Neu. Entd., 2 : 50) points out Pursh's error, stating that the paniculate spikelets are perfect, describing their styles and stigmas; and while apparently not finding stamens in the subterranean spikelets he argues that these must be perfect since they mature their grains before the paniculate spikelets are in anthesis. This latter point does not hold good, however, for specimens are common wherein the two forms of spikelets are strictly contemporary. Gray (1848, Man. 609) gives the first completely accurate description of the genus, "Stamens 3 (small in the radical flowers)."

Description :—Spikelets of two kinds on the same plant, one in a terminal panicle, perfect but not fruitful, the other cleistogamous on slender leafless branches at the base of the culm and subterranean, sometimes also from the lowest nodes; first glume of the aerial spikelets variable in size or obsolete, second and sterile lemma subequal; lemma and palea indurated, margins of lemma, thin, flat; fruiting spikelets much larger, first glume wanting, second glume and sterile lemma strongly nerved, subrigid, exceeded at maturity by the turgid, elliptic acuminate fruit with much indurated lemma and palea, the margins of the lemma thin, flat; stamens with small anthers on short filaments. Two species of the Atlantic coast plain of the United States.

Fig. 5. *Amphicarpon amphicarpon.*

Amphicarpon amphicarpon (Pursh) Nash 1894 , Mem. Torr. Cl. 5:352; based on *Milium amphicarpon* Pursh.

Besides the synonomy given above:

?*Milium ciliatum* Muhl. 1817. Gram. 77. "Habitat in Nova Caesarea." Kunth gives this as synonym under *A. Purshii*, and is followed by later authors, but no one states that he has seen the type.

Amphicarpon floridanum Chapm. 1860, Fl. So. U. S. 572. "Banks of Apalachicola River, Florida."

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

SOME NEW AMPHIBIA SALIENTIA.

BY THOMAS BARBOUR.

Among material selected from the stock of Mr. Owston, in Yokohama, was the remarkable new frog described below. Unfortunately it bears no very definite data. The other two new forms were both taken by the author, while on a collecting trip in 1906–'07.

Rana subaspera sp. nov.

This specimen was sent to Dr. Stejneger for examination. His letter, confirming the surmise that it was undescribed, says: "It is * * * probably nearest related to *Rana feae*, and also to *Rana liebigii* and *Rana boulengeri*." He then calls attention to the enormously developed first metacarpal, "somewhat recalling that of *R. holsti*, with which species, however, the present one has nothing to do." He adds: "The large gland above the axil is also very remarkable."

Description.—Vomerine teeth in two small oblique groups, situated very slightly behind the choanae. The distance between these is a little less than their distance from the choanae. Habit rather stout. Head much broader than long; snout very short, well rounded; no canthus rostralis; nostril much nearer tip of snout than eye; interorbital space narrower than upper eyelid; tympanum distinct, three-fourths the diameter of the eye. Fingers moderate, first much longer than second; first metacarpal very greatly developed (similar to *R. holsti*); toes rather long, entirely webbed; subarticular tubercles well developed; tips of fingers and toes slightly dilated; inner metatarsal tubercle narrow and elongate, two-thirds the length of the inner toe; outer metatarsal tubercle indistinct; no inner tarsal fold. The tibiotarsal articulation reaches the eye; tibia one-half the length of the body.

Body warty, all upper parts and sides of body and limbs with many round, prominent warts. No fold from eye to shoulder as in *R. feae*. A large kidney-shaped gland above each axil. Uniform olive brown on all upper surfaces and sides; tympanum lighter; under surfaces chestnut brown with olive marblings. Male without internal vocal sacs. The type, a male, evidently taken in the breeding season, has light-colored spine-

like asperities on the two inner figures; there are, as in *R. liebigii*, asperities on the inner side of the arms and unlike that frog, these are plentifully sprinkled over the entire chest and throat region to the very edges of the lips.

Type, No. 2440 of the Amphibian collection in the Museum of Comparative Zoölogy. Taken in the Riu Kiu Islands, May, 1904, by a Japanese collector of Mr. Alan Owston.

Cornufer corrugatus rubristriatus subsp. nov.

Description.—These two examples, one of which has been figured in the life colors (for a general account of my collection), seem to differ rather widely from typical *C. corrugatus*.

They both lack the characteristic dermal fold which extends from the eye to the shoulder. The tympana are round instead of vertically oval, there are three palmar tubercles, and the tibiotarsal articulation only reaches the eye. The inner sides of the thighs are yellow, and down the brownish olive back runs a brick red vertebral stripe.

In other characters there does not occur any such divergence. It seems best to consider this a localized island race, and not a distinct species; though more specimens of various ages and from a number of localities might completely separate this race or possibly invalidate it altogether.

Types, No. 2441, Museum of Comparative Zoölogy. Two specimens from Roon Island, Geelvink Bay, Dutch New Guinea. T. Barbour, collector.

Ixalus pallidipes sp. nov.

Description.—Snout rounded, as long as diameter of orbit; canthus rostralis moderately distinct; loreal region slightly concave; nostril slightly nearer tip of snout than eye; interorbital space broader than upper eyelid; tympanum very small, round, rather indistinct, one-fifth diameter of eye. Fingers free, toes not quite half webbed; disks prominent, larger than tympanum; subarticular tubercles small, a small elongate inner metatarsal tubercle. The hind limb being carried forward along the body, the tibiotarsal articulation reaches beyond the tip of the snout. Skin minutely granular above; beneath both throat and belly more coarsely granular. Upper surfaces uniform brown, varying from dark reddish to grayish. Palms of hands and ends of toes yellow. Throat so heavily punctulate with dark brown as to appear almost of solid color, belly and inner sides of limbs less heavily specked on a yellow ground. Outer sides of thighs barred with very deep brown.

Type, No. 2442, Museum of Comparative Zoölogy, from near the summit of the volcano Pangerango, Java. T. Barbour, collector.

The small size (body 1 inch long for nearly adult female), lack of cranial ossification, and absence of vomerine teeth place this form with the genus *Ixalus*. The fact, however, that two species of *Polypedates* have been discovered, viz. *P. edentulus* (F. Müll), and *P. anodon* (Van Kampen), which also lack vomerine teeth, shows how scant is the basis of separation for the two genera. Cranial ossification is unknown in *Ixalus*, and, of course, is not general in *Polypedates* so that the adult size alone stands as the generic distinction. A very slim one surely.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

DIAGNOSES OF SOME NEW FORMS OF NEOTROPICAL BIRDS.

BY ROBERT RIDGWAY.

[By permission of the Secretary of the Smithsonian Institution.]

1. **Thryorchilus basultoi** sp. nov.

Type from Las Vueltas, Cordillera de Dota, Costa Rica; No. 209,935, U. S. National Museum; adult female; May 21, 1908; Francisco Basulto.

Differing from *T. browni browni* and *T. browni ridgwayi* in having the pileum and hindneck and auricular area dark sepia or nearly clove brown, strongly contrasted with the mummy brown of back, instead of concolor with the latter; superciliary stripe much broader, pure white; white of under parts much purer, and white markings on wings more conspicuous; wing and tail decidedly longer, but bill much shorter and relatively stouter. Length (skin), 95mm.; wing, 52; tail, 32.5; exposed culmen, 11.5; tarsus, 22.5; middle toe, 15.

Named in compliment to Don Francisco Basulto, of Cienfuegos, Cuba, to whom I am indebted for valuable assistance during my recent collecting trip to Costa Rica.

2. **Coryphotriccus albovittatus distinctus** subsp. nov.

Type from Rio Reventazón (near Guayabo Station), eastern Costa Rica; No. 209,464, U. S. National Museum; adult male; March 18, 1908; Francisco Basulto.

Similar to *C. albovittatus* (Lawrence), from line of Panama Railway, but decidedly larger; back, etc., much grayer olive; yellow of under parts paler (light canary yellow instead of nearly lemon yellow); and blackish area on side of head much broader. Length (skin), 155mm.; wing, 87; tail, 68; exposed culmen, 15.5; tarsus, 19; middle toe, 14.

(*THAMNOPHILUS DOLIATUS.*)

The geographic variations of this species, which inhabits the whole of Central America and tropical parts of Mexico (except the Pacific slope of the latter), together with Cayenne, Surinam, British Guiana, Venezuela, Trinidad, and Tobago, have not been thoroughly worked out. It is very

difficult to get together sufficient material to form a basis for such an attempt, and I have been able to study the subject from material that is only approximately adequate. The type locality of *Lanius doliatus* Linnæus is Cayenne; and since the birds of this species from Venezuela, Trinidad, and Tobago are recognizably different the name *doliatus* must be restricted to those from the Guianas. In Colombia and eastern Panama the range of this species is completely interrupted. *T. radiatus nigricristatus* (and *T. radiatus albicans*, if really distinct) entirely replacing it, and it does not reappear until western Panama (Chiriqui) is reached, whence northward to the States of Tamaulipas and San Luis Potosi on the eastern side and Chiapas on the Pacific side of Mexico the species occurs throughout the hot and temperate zones. Notwithstanding their wide geographic separation from their South American representatives, *T. doliatus doliatus* of Cayenne, Surinam, and British Guiana and *T. doliatus fraterculus* Berlepsch and Hartert,* of Venezuela, Trinidad, and Tobago, some specimens from the Central American area closely resemble one or the other of the two South American forms. On the whole, however, the Central American birds are obviously different; but owing to the very considerable amount of individual variation among specimens from almost any locality within the area designated it is very difficult to make out geographic forms which can be satisfactorily characterized. The *average* difference in coloration between specimens from the Atlantic and Pacific slopes, respectively, is very marked, those from the former being much darker, this darkness of coloration reaching its maximum development in Honduras, where, however, most specimens are hardly if at all distinguishable from the darker examples from eastern Mexico. In Yucatan, however, the birds of this species are all light colored, resembling those from the Pacific coast district much more closely than they do those of Honduras and the eastern parts of Guatemala and Mexico. The difference in coloration between specimens from opposite sides of the continent is much less marked as well as less constant in Costa Rica than in the countries farther northward, many of those from the Pacific side being quite as dark as some of those from the Atlantic side.

In short, while puzzling exceptions to the general rule occur, it appears, from the material examined, that three fairly definite geographic forms of this species may be made out in Central America, two of which apparently have not been named. These are

(1) *Thamnophilus doliatus mexicanus* Allen. Atlantic slope, from southern Tamaulipas to Costa Rica, of which *T. intermedius* Ridgway† represents the dark extreme. Type locality, Jalapa, Vera Cruz.

(2) *Thamnophilus doliatus pacificus* Ridgway. Pacific slope, from Chiapas to western Panama. (An earlier name for this may be *Thamnophilus rutilus* Bonaparte,‡ described as from Guatemala; but it being

* Novit. Zool., ix, no. 1, April 10, 1902, 70 (type locality, Altagracia, Orinoco R., Venezuela; coll. Tring Mus.).

† Proc. U. S. Nat. Mus., x, sig. 37, Aug. 6, 1888, 581 (Truxillo, Honduras; coll. U. S. Nat. Mus.).

‡ Proc. Zool. Soc. Lond. 1837, 117.

impossible to tell whether this represents the Atlantic or the Pacific form, it seems better to give the present form a new name.

(3) *Thamnophilus doliatus yucatanensis* Ridgway.

3. **Thamnophilus doliatus pacificus** subsp. nov.

Type from Chinandega, Nicaragua; No. 210,721, coll. U. S. National Museum; adult male; F. Hicks.

Similar to *T. d. mexicanus* Allen, but adult male with under parts decidedly paler, the black bars decidedly, sometimes very much, narrower than the white interspaces, black streaks on throat very narrow. Length (skin), 144mm.; wing, 67; tail, 58.5; culmen, 18.5; tarsus, 25; middle toe, 15.

4. **Thamnophilus doliatus yucatanensis** subsp. nov.

Type from Temax, Yucatan; No. 147,405, coll. U. S. National Museum; adult male; 1883; G. F. Gaumer.

Similar to *T. d. pacificus*, but adult male with black bars on under parts usually narrower; adult female with upper parts (except pileum) averaging more ochraceous (less rufescent), the wings (sometimes back and tail also) showing more or less distinct indications of dusky bars. Length (skin), 168mm.; wing, 73; tail, 65; culmen, 19.5; tarsus, 27; middle toe, 16.

5. **Dysithamnus mentalis septentrionalis** subsp. nov.

Type from Choctum, Vera Paz, Guatemala; No. 30,784, U. S. National Museum; O. Salvin.

Similar to *D. mentalis semicinereus* (Sclater), of Colombia, but decidedly smaller; adult male with upper parts paler, adult female with sides and flanks paler olive. Wing, 58.5mm.; tail, 38.5; culmen, 15; tarsus, 19; middle toe, 11.5.

Range.—Panama to Guatemala (to western Ecuador also?).

6. **Dysithamnus mentalis oberi** subsp. nov.

Type from Tobago; No. 115,046, U. S. National Museum; adult male; May; F. A. Ober.

Similar to *D. mentalis semicinereus* but still larger, and coloration paler and duller. Wing, 64.5mm.; tail, 44; exposed culmen, 15; tarsus, 20; middle toe, 11.5mm.

7. **Thamnistes anabatinus saturatus** subsp. nov.

Type from Bonilla, Costa Rica (Atlantic side, 2,600 ft. alt.); No. 199,066, U. S. National Museum; April 8, 1905; R. Ridgway.

Differing from *T. anabatinus anabatinus*, of Guatemala and southern Mexico, in much darker and less ochraceous coloration, the wings much browner (less rufescent). Length (skin), 129mm.; wing, 67; tail, 48.5; culmen, 19; tarsus, 20.5; middle toe, 12.

8. **Drymophila grisea margaritensis** subsp. nov.

Type from Margarita Island, Venezuela; No. 151,709, coll. U. S. National Museum; adult male; July 10, 1895; Lieut. Wirt Robinson, U. S. A.

Similar in coloration to *D. grisea tobagensis* (Dalmas), but decidedly smaller. Wing of adult male, 53–54.5mm.; tail, 46–49; exposed culmen, 14–14.5; tarsus, 20–21; middle toe, 11–11.5.

9. **Myrmeciza boucardi panamensis** subsp. nov.

Type from Panama (line of Panama Railway); No. 53,790, U. S. National Museum; J. McLeannan.

Nearest to *M. boucardi swainsoni*, but adult male with gray outsides of chest darker and more extensive, the tawny of flanks and under tail-coverts also deeper.

10. **Myrmelastes cassini** sp. nov.

Type from Turbo, northwestern Colombia; No. 21,739, coll. U. S. National Museum; A. Schott.

Similar to *M. maculifer* (Hellmayr),* but much paler, the adult male having the back, rump, etc., light mars instead of deep vandyke brown, the head (all round) dark slate color instead of slate-black, and the chest, breast, and abdomen slate-gray instead of blackish slate. Wing, 69.5mm.; tail, 42; tarsus, 29; middle toe, 17.

Besides the type, there are in the National Museum collection an adult female from Turbo and another (erroneously marked "♂" by the collector) from Cascajal, Coclé, Panama.

This form agrees with *M. maculifer* in its relatively very short tail (as compared with *M. exsul* and *M. exsul occidentalis*), and also in having *all* the wing-coverts marked with a terminal white spot, and may be only subspecifically distinct; but the coloration is so conspicuously different that at present, or until actual intermediates are found, I prefer to designate it by a binomial.

11. **Gymnocichla nudiceps sancta-martæ** subsp. nov.

Type from Santa Marta, Colombia; No. 28,163, U. S. National Museum.

Similar to *G. nudiceps nudiceps*, but adult male with under wing-coverts broadly margined with white, instead of being uniform black, and white terminal margins to wing-coverts broader. Length (skin), 161mm.; wing, 81; tail, 60; culmen, 21; tarsus, 30; middle toe, 19.

12. **Formicarius moniliger intermedius** subsp. nov.

Type from forest near Manatee Lagoon, British Honduras; No. 27,686, coll. Carnegie Museum; adult male; Feb. 28, 1906; Morton E. Peck.

Most like *F. m. pallidus* (Lawrence), from Yucatan, but general color of upper parts darker and more rufescent (raw-umber brown instead of between broccoli brown and isabella color), that of under parts clearer gray (mouse gray instead of drab gray).

* *Myrmelastes exsul maculifer* Hellmayr, Novit. Zool., xiii, no. 2, July, 1906, 340, 342 (Paramba, n. w. Ecuador; coll. Tring Mus.).

This form is evidently quite distinct specifically from *Myrmeciza exsul* Sclater (=*M. immaculata* Sclater and Salvin = *M. intermedia* Cherrie!).

13. **Formicarius moniliger panamensis** subsp. nov.

Type from Panama (Lion Hill Station?); No. 53,779, coll. U. S. National Museum; adult male; J. McLeannan.

Similar to *F. moniliger hoffmanni* (Cabanis), of southwestern Costa Rica and northwestern Panama, but averaging smaller, and coloration constantly lighter, with under parts strongly suffused with olive and buffy and color of under tail-coverts lighter, more tawny. Length (skin), 169.5mm.; wing, 87; tail, 55; culmen, 21; tarsus, 30; middle toe, 18.5.

14. **Delattria henrica salvini** subsp. nov.

Type from Calderas, Volcan de Fuego (7,000 to 8,000 ft.), Guatemala; No. 46,304, American Museum Natural History; September, 1873; Osbert Salvin.

Much darker than *D. henrica henrica*; similar in general coloration to *D. henrica brevirostris*, but smaller, with relatively longer bill, the dusky auricular-suborbital area much darker (brownish-black), the post-ocular streak much broader, pure white, and margined above by a line of black.

Adult male (type).—Length (skin), 116mm.; wing, 67; tail, 40.5; exposed culmen, 20.

An adult male in the Biological Survey collection, from San Cristobal, Chiapas (No. 155,236, U. S. National Museum, September 17, 1895, Nelson and Goldman), is referred provisionally to this form. It agrees in coloration with the type, but is smaller, measuring as follows: Length (skin), 106mm.; wing, 63.5; tail, 38.5; exposed culmen, 19.

15. **Delattria henrica brevirostris** subsp. nov.

Type from San Sabastian, Jalisco, western Mexico; No. 155,982, U. S. National Museum (Biological Survey collection); adult male; March 17, 1897; Nelson and Goldman.

Similar to *D. henrica henrica*, of southeastern Mexico (States of Vera Cruz and Oaxaca), but with bill relatively much shorter, color of under parts darker and more uniform (deep mouse gray or brownish slate gray), and feathers of throat with whitish margins much narrower and less distinct.

Length (skin of type), 118mm.; wing, 70; tail, 44; exposed culmen, 19.

16. **Stenopsis tobagensis** sp. nov.

Type from Tobago; No. 74,877, coll. U. S. National Museum; adult male; F. A. Ober.

Similar to *S. insularis* Richmond,* in possessing a single narrow dusky band across the middle of tail and in having the inner webs of all the rectrices except middle pair mostly white, but coloration much darker and less buffy, wing longer, and tail decidedly shorter. Differs from *S. cayennensis* in lighter coloration, much greater amount of white on lateral rectrices, and in shorter wing and tail. Wing, 137mm.; tail, 113; culmen, 13; tarsus, 16; middle toe, 15.

* *Stenopsis cayennensis insularis* Richmond, Proc. Biol. Soc. Wash., XV, June 25, 1902, 159 (Curaçao; coll. U. S. Nat. Mus.).

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PROCEEDINGS

OF THE

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A NEW HARVEST MOUSE FROM THE SALT MARSHES OF SAN FRANCISCO BAY, CALIFORNIA.

BY JOSEPH DIXON

Stanford University, California.

For the past forty years Mr. Chase Littlejohn, of Redwood City, has been aware of the existence of a little red-bellied mouse in the salt marshes of San Francisco Bay near his home; but since the mouse was so common and well known to him he supposed that it was one of the well known species. Last fall he showed me a number of alcoholic specimens of this mouse and wished to find out what it was.

The material at hand was unsatisfactory to work with, so we set to work to gather some new material which now consists of some twenty-six study skins and skulls from various representative points around San Francisco Bay. A close study of this material led us to believe that the mouse was an unknown form restricted to the salt marshes of San Francisco Bay. The material was sent to Washington, and a comparison of it with the material in the Biological Survey Collection resulted in the decision that it was a "very good new form," which I hereby describe as:

Reithrodontomys raviventris sp. nov.

Type.—male; number 475, collection of University of California Museum of Vertebrate Zoology (original number, 134); Redwood City, San Mateo County, Calif.; collected by Chase Littlejohn; Jan. 15, 1908.

Geographic distribution.—Salt marshes of San Francisco Bay.

Habitat.—Restricted to the salt marsh. During the winter and high tides, they congregate along the old dikes and other high places, but during the summer they scatter out in the Salicornia toward the bay shore. In the salt marsh near Palo Alto, this mouse was found using the runways of *Microtus* extensively.

Color.—Hairs on back extensively tipped with black which gives the dorsal surface a much darker appearance than in *R. longicauda.* Sides of nose brownish black. Lips black. Sometimes a white spot on chin. Feet are of a purple tint during life, and are very much darker, both above and below, than in *R. longicauda.* The toes of the front feet are pure white during life. The tail is very indistinctly bicolored, if at all. There is a decided fulvous spot at the anterior base of the ear, which is a great deal darker than in *R. longicauda.* The underparts are a bright fulvous which contrasts strikingly with the grayish white underparts of *R. longicauda.*

Measurements.—A series of twenty-one *R. raviventris* from Redwood City, average: length, 130.7 (120–142); tail, 64.8 (56–74); hind foot, 16.6 (15–18); ratio of tail to total length, 49.5%. A series of four from Palo Alto, Santa Clara County, Calif., average: length, 130.2 (121–139); tail, 63.5 (58–68); hind foot, 16.7 (16–17). A single specimen from Elmhurst, near Oakland, measures: length, 146; tail, 70; hind foot, 17.

A skull, number 158, ♀, in my collection measures: basal length, 16.2; nasals, 6.9; zygomatic breadth, 9; alveolar length of series of upper molars, 2.9. This skull is possibly a little smaller than the average.

Remarks.—This form is distinguishable from *R. longicauda* which inhabits the foothills surrounding the bay, by its much denser fur, which is darker both at the base and at the tips. The feet are very much darker than in the upland form, as are also the ears. The tail is not distinctly bicolored, as in *R. longicauda*, and the red belly is very noticeable in comparison.

Vol. XXI, pp. 199-206 November 24, 1908

PROCEEDINGS

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NOTES ON THE LIFE HISTORY OF *SCAPHIOPUS COUCHII* BAIRD.

BY JOHN K. STRECKER, JR.

Baylor University, Waco, Texas.

The geographical range of Couch's Spadefoot (*Scaphiopus couchii* Baird) is, even at this late date, very imperfectly known. In Texas I have traced it north to within fifty miles of Fort Worth. It is an abundant species in the coast region, from Refugio south to the mouth of the Rio Grande River, but it does not appear to range east of the 96th parallel. It inhabits the entire Rio Grande Valley from Brownsville to El Paso. It is as common in central Texas (Waco and Burnet) as it is in the southern portion, and this leads me to believe that its Texas range is far more extensive than is at present known. The only authentic record I have for the Territory of New Mexico is based on a single example from the White Mountains, sent me for identification by Messrs. Townsend and Barber. In Mexico it is found along the northeastern boundary, in the States of Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas, and in the Cape region of Lower California. Definite localities for central and western Mexico are lacking. This leaves an extensive range of country from which our museums possess no specimens, but it is reasonable to suppose that the animal is found as far south as Durango and Victoria.

As can be seen by the foregoing, *Scaphiopus couchii* is found in the more elevated districts as well as in the low-lands, and to judge from the altitudes of recorded localities there is a possibility of its extending from the Lower Sonoran zone into the edge of the Upper Sonoran in western Texas and southern New Mexico. At Brownsville, Texas, the altitude is only about 36 feet, while the White Mountain, New Mexico, specimen was collected at approximately 5200 feet. The altitude of Waco,

Texas, is about 410 feet, Burnet, 1300 feet, and El Paso, 3700 feet. In southeastern Texas (Refugio) its range overlaps that of the eastern spadefoot (*Scaphiopus holbrookii* Harlan) and in the western part of the State (El Paso) it has been found breeding in company with *S. hammondii* Baird.

At Waco I have found the following species of Salientia in pools occupied by *Scaphiopus couchii: Bufo compactilis* Wieg., *Bufo punctatus* B. & G., *Bufo valliceps* Wieg., *Bufo debilis* Girard, *Bufo americanus* Le Conte (var.), *Engystoma carolinense* Holbrook. The first four of these are typical Sonoran species; the last two are Austroriparian forms.

In the following pages the descriptions are based on specimens from Waco, Texas, and the northern part of the State of Chihuahua, Mexico. It was not possible to examine fresh material from Lower California, and I am therefore unable to make comparisons between examples from the northern and southern limits of its range. The specimens from Miraflores and San Jose del Cabo in the collection of the California Academy of Sciences were destroyed in the great fire, while the La Paz and Cape St. Lucas specimens in the United States National Museum have been in spirits for many years and are therefore worthless for purposes of comparison, when color characteristics are taken into consideration. In living specimens the coloration is very variable, and a series will show several very distinct types. The general color of the upper parts, in all specimens examined by me, was of some shade of green.

Life Coloration of Adults.

Type A.—Above, uniformly light yellowish-green to dark green with traces of darker markings in the dorsal region, but presenting no distinct pattern. Under parts, white. One specimen was dark ochre-yellow above with darker areas on the back. Under parts white, excepting on the belly, which was rusty yellow. Inner surfaces of limbs, light rust color.

Type B.—General coloration as in A, but there are numerous small black spots scattered all over the dorsal area. In specimens preserved in spirits these spots persist after the bright colors have faded out.

Type C.—This is the banded or cross-barred type described by Cope. I here repeat his description: "Color above, yellow-

ish, with irregular brown bands which converge between and behind the orbits; others diverge on the flanks, beginning at the orbits; one from same point to hip, and one to canthus rostralis. There is a confluence of dorsal bands near the sacrum. A light band on outer face of tarsus and toe." *

In life examples of Type A present the appearance of plainly colored, unmarked animals. The markings in the third type, however, are very conspicuous in both living and preserved specimens. In my report on the reptiles of McLennan County,† Texas, through a careless reading of the manuscript, I am made to say that the majority of the cross-barred examples are *males*, when I intended to say *females*. During the months of April and May of this year I collected 87 adult examples of this species. Forty-two of these were females, all cross-barred. Of the forty-five males, thirty-eight were of Type A, the others were of Type B.

Descriptions of Young Specimens.

Example A.—Length 16 mm. Tail not fully absorbed. Above, dark brown, appearing blackish when placed in water. Under parts, dirty white. Spur fully formed, blackish-brown in color. Locality, Waco, Texas. Captured while endeavoring to burrow in the soft earth a short distance from the breeding pool.

Examples B and C.—Length, 18 and 19 mm. Above, dark brown, lighter on the sides and limbs. Under parts, dirty white. Tail fully absorbed. Localities, Waco, Texas, and Lake Guzman, Chihuahua.

Example D.—Length, 26 mm. Light yellowish-green above with scattered blackish dots in the dorsal region. Under parts, white. Locality, Sabinal, Chihuahua.

Examples E to H, Inclusive.—Yellow-green with dark cross-bars. Markings darker and more distinctly defined than in older examples. Length, 28 to 32 mm. These specimens were captured in the damp grass a couple of yards from a pool in which a number of adults were breeding. Locality, Waco, Texas.

* The Batrachia of North America.
† Proc. Biol. Soc. Wash., XXI, 1908, p. 80.

Breeding Habits.—The clasp of the male is inguinal as is usual in the family (*Pelobatidae*). About three hours is usually required for the laying of the complement of from 350 to 500 eggs, and during this time there are from four to eight periods of sexual activity. A captive pair remained in copula for nearly eight hours but this is unusual.

The eggs are in strings, in double and even triple rows. These strings range from 1½ to 2½ inches in length, and the number of eggs in a string varies from 45 to 125. The pigmented portion of the egg is black and the yolk porcelain white, while the surrounding jelly mass is almost colorless. The diameter is about one-sixteenth of an inch. The largest number deposited by one female was 528; the smallest, 343.

The eggs are attached to grass, weeds and rootlets, in from 3 to 6 inches of water. They are very bouyant and readily float on the surface. I made a careful count of the number of eggs in the eleven strings comprised in two full complements, and the result is as follows:

								Total.
Lot A	76	78	79	110				343
Lot B	81	124	66	49	54	86	45	505

The eggs hatch in from eight to ten days. The newly hatched larvae are tender and rather inactive, but their growth is exceedingly rapid, and within the course of a very few days they are swimming freely in the shallower portions of the pond. In form the week-old tadpole is short and plump. The general color is blackish-brown, lighter on the belly and tail. The latter, which is unusually slender, is sometimes more or less blotched and spotted with darker shades.

On the 12th or 13th day after hatching the limbs begin to appear, and from this time until they are ready to leave the water the tadpoles are usually found in shallow water close in to the edge of the bank. A dip-net will bring up scores of them in one sweep. On the 19th or 20th day the little animals leave the water with their tails still in evidence. They are now about 14 or 15 mm. in length, and the short tail is probably absorbed within the next three or four days. It is a difficult matter to be certain of this, however, as they commence to burrow within a few hours after leaving the water.

The coloration is now essentially that of Example B (see the descriptions of young specimens), and it is probably several weeks before they assume that of the adult. The young specimens described as Examples E to H were collected in July, 1898, and by a reference to my notes I find that *Scaphiopus* were breeding in May of that year. After making a proper allowance for the time necessary for them to go through their transformation we can be reasonably certain that these specimens were about four or five weeks old.

The most of the above observations were made at a series of temporary ponds located on the flats west of Waco. They were commenced during a spell of rainy weather lasting for several days, and all of the eggs were not deposited on the same night. This will account for the difference in the time of hatching.

Voice.—The cry of the male is a loud, resonant "yē-ŏw" repeated at intervals; that of the female, a short, grunting "ŏw" uttered several times with shorter intermissions. The vocal vesicle of the male is unusually large, expanding at the throat, sides and breast. Fully distended it is about three times the size of the head, and as seen rising and falling on a level with the surface of the water, when the animal utters its cry, it presents the appearance of a small silvery-white bladder.

The voice of this species is much louder than that of any of our other toads and frogs, and many persons claim that it is almost impossible for them to sleep while the animals are howling in an adjoining lot. In confinement the males utter low, plaintive cries quite different from their usual loud notes.

Food.—The stomachs of several examples collected near electric lights contained the remains of various species of beetles, flies and moths. Specimens thus captured are never found out in the open, exposed to the full glare of the light, but are usually discovered lurking under cover of grass and weeds. It would seem as though they were lying in wait for the insects that succeed in escaping the other species of toads which usually congregate in such places. A florist who has placed a number of *Scaphiopus* in his flower pit informs me that their diet consists largely of earthworms.

General Notes.—This species is not as retiring as its eastern relative, *Scaphiopus holbrookii.* In fact its general habits show a resemblance to those of the night-prowling toads such as *Bufo debilis* Girard and *B. compactilis* Wieg.

In former years I have known specimens of Couch's spadefoot to come out of their burrows on rainy days as early as three o'clock in the afternoon, and during the present year I captured examples as late as ten o'clock in the morning. After the breeding season is over it is only occasionally that one will run across a specimen out of its burrow.

Judging from the published accounts of the habitation of *Scaphiopus holbrookii*, I should say that the burrow of our species was similar in every respect. On account of its abundance it is not an uncommon occurrence for a gardener to unearth four or five examples during the course of a single morning's work. The truck gardeners know the animal as the "green burrowing-toad."

In her excellent account of *Scaphiopus holbrookii* Miss Dickerson makes the following remarks: "After the eggs are laid the spadefoot toads disappear entirely, leaving no trace of their hiding place. In fact it is not known whether they burrow in low land where temporary pools are likely to form, or whether they go a considerable distance into higher land before they burrow. At any rate these facts are well authenticated: they disappear with never a stray one behind, and they may not reappear again in the same locality for years." *

In reply to these remarks I can state with certainty that our spadefoot *does* burrow in the neighborhood of its breeding places. I have on several occasions unearthed both adult and young specimens within a few yards of a pool in which hundreds of tadpoles had undergone their transformation.

Our species appears in numbers as regularly as the year comes around, and my note book shows an unbroken record for the period from 1895 to 1908. In some years the animals seem more abundant than in others.

I have known them to go in the water as early as the tenth of April, but in 1905 they were unable to find suitable breeding places until the latter part of July. As a usual thing, however, the majority breed during the month of May.

This year I found eggs at three different times within a period of seven weeks, which proves conclusively to my mind that all of our spadefoot toads do not breed at the same time.

* The Frog Book, New York, 1906, pp. 55-56.

When the animals are in the water they swim in short spurts. If the pool is deep they disappear beneath the surface at the slightest alarm, but if it is shallow they flounder rather helplessly.

Early one rainy morning in May I captured a male spadefoot in my front yard, and hearing the cries of others in the adjoining lots I decided to spend a couple of hours in investigating their breeding habits. I dressed to suit the occasion and after providing myself with a perforated fish-bucket and a dip-net, crossed over into the next yard and took up my station in an old, dismantled frame building. The water was from four to six inches deep and only the tops of the taller weeds and grass stalks were above the surface. I remained perfectly quiet for several minutes, keeping my eyes riveted on several grass patches near at hand. In a short space of time my patience was rewarded by the appearance of a yellowish-green head with unusually prominent golden eyes. The spadefoot swam clumsily in the direction of a nearby grass clump and when he had reached it he drew himself partly out of the water and gave vent to a long-drawn "yē-ŏw." His cry acted as a signal, for immediately *Scaphiopus* in all portions of the yard responded lustily and the chorus was almost deafening. While my male was giving vent to his cry it seemed as though the air in his pouch made him shaky and he had trouble in keeping his equilibrium, rolling from side to side and treading water rather aimlessly.

A female began to grunt, and by the time I could slip around to a point of vantage the male had her in his embrace. I slipped back to cover, and as the pair were only about two yards from the building I could watch them through a crack in the wall.

In about twenty-five minutes the animals went through some peculiar contortions, indicating that they were in the act of laying the first batch of eggs and I decided that it was time to transfer them to my bucket. Attached to a grass blade was the first emission of eggs, 80 in number, arranged in a double string. While the female was depositing these eggs she grasped the grass-stalk with her fore-feet and drew the male above the surface of the water. Prior to the emission only his head and shoulders were visible.

The male is very ardent in his attentions, and if forcibly

separated from the female utters low plaintive cries and grasps aimlessly at any object that is presented to him. I kept a mated pair and four extra males confined in a fish bucket for a short time and was compelled to *separate them*, as the latter would persist in grasping the hind legs of the other male and it was a difficult matter to get them to relinquish their hold.

The number of specimens that make their appearance within the limits of the city of Waco is simply enormous. In a vacant lot across the street from my house I captured twenty-two examples between twilight and dark, and to judge from the sounds made by those that were left it seemed as though the number was scarcely diminished. In a horse-lot across the alley from this place there must have been at least a couple of dozen more. In a section of the city twelve blocks long by three blocks wide there are at least twenty-five places where spadefoot toads congregate in numbers. The next morning after an unusually heavy rain hundreds of strings of eggs will be found in these places. None of these eggs ever hatch but are dried up in the course of the next twenty-four hours.

In East Waco and on the flats west of the city, however, there are low places where the water stands for a couple of months or more and in these ponds young spadefoot toads are reared by the thousands.

In concluding this paper I desire to thank Dr. Leonard Stejneger, United States National Museum; Dr. John Van Denburgh, California Academy of Sciences, and Dr. Seth Eugene Meek, Field Museum of Natural History, for their kindness in furnishing me with lists of the localities from which their respective institutions have received specimens of *Scaphiopus couchii*.

All of the other notes are original and all descriptions of young and adult specimens are based on examples preserved in the Museum of Baylor University.

There is a wide field open to the student of Batrachology, and as a large per cent of our most interesting forms inhabit sections of the country far removed from the great museums and laboratories it remains for local observers to supply what information they can in regard to the life histories of those forms of which we as yet know little or nothing.

Vol. XXI, pp. 207-210 November 24, 1908

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NOTES ON A PIPEFISH FROM THE MID-NORTH ATLANTIC.

BY BARTON W. EVERMANN AND WILLIAM C. KENDALL.

In October, 1901, the U. S. Fish Commission received two specimens of pipefish from Lieut.-Commander James H. Sears, U. S. N., in charge of the Branch Hydrographic Office at New York. They were handed him by Captain Henry Eagleton of the S. S. *Trojan Prince*, with the information that they had been saved from a mass of 20 or more that had fouled the patent log during the night of October 16, in Lat. 44.5° North ; Long. 33° West, causing an error of about 25°.

Captain Eagleton stated that the first officer was observed clearing the log of a mass of what he supposed were "marine worms" and the captain was in time to save two specimens. When these specimens were received by the Bureau of Fisheries they were rather badly broken ; one lacking a portion of the head only was sufficiently intact to permit of positive identification. The other specimen lacked the head and a portion of the tail. Upon examination they proved to be the young of *Nerophis aequoreus* (Linnæus), a common European species. Günther* gives its geographic distribution as, "Northern and western Europe; New Orleans." As this species has never been noticed on the coasts of America, Günther's reference to New Orleans is doubtless an error.

Couch† says, "It is more an inhabitant of the open ocean, where, in summer, fishermen report that they see it near the surface over a depth of more than fifty fathoms, at a distance from land of ten or fifteen leagues."

* Cat. Fish. Brit. Mus., VIII, 191, 1870.

† Fishes of the British Islands.

The most western records are from the neighborhood of the Azores. The British Museum has specimens from north of the Azores. In a report (1896) on the fishes collected during explorations by the Prince of Monaco's yacht *L'Hirondelle*, in 1885–1888, Collett records a specimen from Lat. 39° 22′ 48″ N.; Long. 33° 45′ 30″ W., taken at the surface over 1384 metres.

The locality from which the present specimens were obtained lies about in a direct line between the southern end of Cape Sambro, Nova Scotia, and the south point at the entrance of Bassin d'Arachon, Atlantic coast of southern France; and northward of the Azores, a little east, but some 360 nautical miles north of the Hirondelle station.

Couch states that it "abounds in incalculable numbers from near the shore to several miles in the open sea; and it is then they appear to perform a perhaps limited migration or change of quarters; for they swarm at the surface in fine weather from the early part of summer to its declination; but after this time they are not seen and perhaps have gone to the bottom and into deep water."

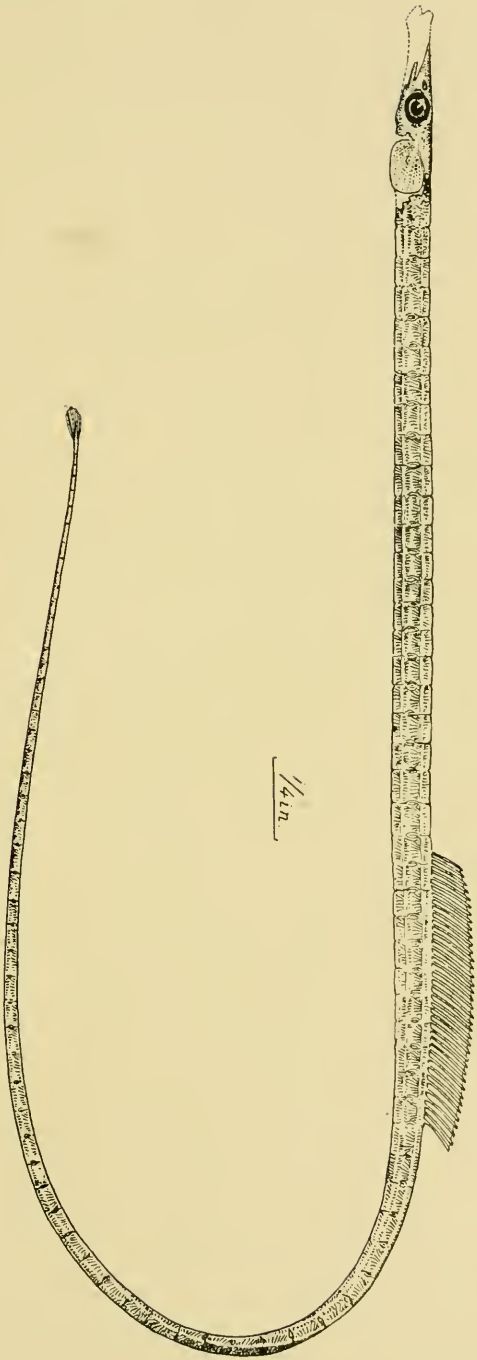
Owing to their structure, their swimming powers are limited and their migrations restricted to such as they accomplish by taking passage on a piece of floating seaweed, to which they attach themselves by their somewhat prehensile tail. The direction of the migration, therefore, is dependent mainly upon tides and currents, and those found north of the Azores probably reached those places by this means.

This species attains the largest size of any of the pipe fishes. Individuals are said to have been observed having a length of 2 or 3 feet, but as commonly met with they are not so long.

An interesting account illustrating the size attained by this fish is given by Blake-Knox, Zoology, 1866, p. 508:

"Last winter I met with an immense fish of this kind. Seeing a boy whacking a donkey with a gutta percha stick, as I thought, I asked him where he got it. 'It's only the stock of a snot (seaweed), sir; see?' and I did see a fine æquoreal 3 feet 5 inches long. Of its toughness you may judge. It is not uncommonly taken in baskets with whelks and crabs."

As previously mentioned, the present specimens are young individuals, the most perfect specimen being about 7 inches



Nerophis aquoreus (Linnæus).

long. This specimen has a distinct caudal fin composed of five rays, of which the middle one is the longest. The dorsal is situated on $7\frac{1}{2} + 3$ rings and consists of 38 rays. The rings of the trunk are about 30 + 39 or 60. The dorsal of the second specimen has forty rays and is situated on $7\frac{1}{2} + 3$ rings.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

A NEW SHIPWORM FROM THE UNITED STATES.*

BY PAUL BARTSCH,

ASSISTANT CURATOR DIVISION OF MOLLUSKS, U. S. NATL. MUS.

In revising the collection of American shipworms in the U. S. National Museum, I find that the commonest one of the East Coast species is an undescribed form which has been variously referred to *Xylotrya palmulata*, *bipalmulata*, *bipinnata* and *fimbriata*. It may be known as

Xylotrya gouldi sp. nov.

Exterior.—Shell subglobose, milk white. The shell is divided into three parts, an anterior and posterior projection and a main or central part. Anterior projection not quite as high as the umbo, large and expanded, differentiated from the central part of the shell by a well-marked constriction. Posterior notch forming an angle a little greater than a right angle. The posterior projection is marked by a series of parallel, equal and equally spaced, subtriangular and subacute, exceedingly finely denticulate ridges which are about three-quarters as wide at their base as the flat spaces that separate them. There are nine (9) of these ridges in the space of one millimeter at the junction of the posterior projection with the central part of the shell. The central part of the shell is divided into three parts. An anterior, well-rounded, smooth portion, which is marked by lines of growth only; a median centrally moderately depressed area, which is marked by strong lines of growth on the anterior half, and very strong, irregular, raised, rough lines on its posterior half; the third or posterior portion is sculptured with closely crowded, denticulate ridges which are separated by narrow, impressed lines. There are seventeen (17) of these ridges in the space of one millimeter at the posterior margin and about twenty-three enticles to the space of one millimeter on each ridge. The ridges of the posterior area of the central part of the shell run parallel with the posterior margin of the central part, joining the ridges of the posterior projection at a little more than a right angle. Hinge irregularly sinuous. The posterior projection is glazed by a moderately strong, translucent callus at the umbo.

*An author's edition of this paper was printed and distributed December 7, 1908.

Interior.—The anterior projection extends prominently over the central part, at its posterior edge, forming a strong, free lamella. The part anterior to the junction with the central area is marked by many subequal and subequally spaced, slender threads which coincide with the incremental lines. The central part is smooth, except the middle portion, which is decidedly roughened and bears a prominent subcylindric knob at the ventral tip. The fusion of the central area and the posterior projection is marked by a thickened suture. The posterior projection is smooth, but permits the exterior sculpture to be seen through its semi-transparent mass. The blade which extends obliquely from the thickened umbo is rather broad, thin and sickle-shaped.

Pallets plumose, with a slender stalk which is almost as long as the blade. Junction of stalk and blade well marked; the first element of the blade appears as if the stalk were sunk in it. The blade itself is lanceolate, and is formed by a series of depressed cone-in-cone structures which have their bases partly free. The entire blade appears to be covered by a thin, horny film which bridges over the gap between the free base of one cone to the body of the next. The outer surface is well rounded; the free edge of the cone forms a decidedly curved outline, giving the blade the aspect of an ear of rye. The inner surface of the blade is almost flattened, and the elements are less deeply curved than on the outside. There are seventeen (17) joints to the blade of the type.

The type, Cat. No. 27,415 U. S. N. M., was collected in Norfolk Harbor, Va., and measures: altitude 8.6 mm., length 8.5 mm., diameter 9.2 mm., length of the blade of pallet 9.7 mm., greatest diameter of blade 2.0 mm., length of stalk 7.7 mm. The National Museum has specimens of this species from the following localities:

Virginia: Norfolk Harbor, Newport News, Hampton Roads, Smith's Point, Chesapeake Bay. *South Carolina:* Charleston. *Florida:* Cedar Keys, St. Andrews, Pensacola, Pascagoula Bay. *Texas:* Galveston. *Louisiana:* Chandeleur Islands, Cameron. South Atlantic.

Vol. XXI, pp. 213-218 December 10, 1908

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

SMITHSONIAN BIOLOGICAL LIBRARY

LAKE CICOTT, INDIANA, AND NOTES ON ITS FLORA AND FAUNA.

BY BARTON W. EVERMANN AND H. WALTON CLARK.

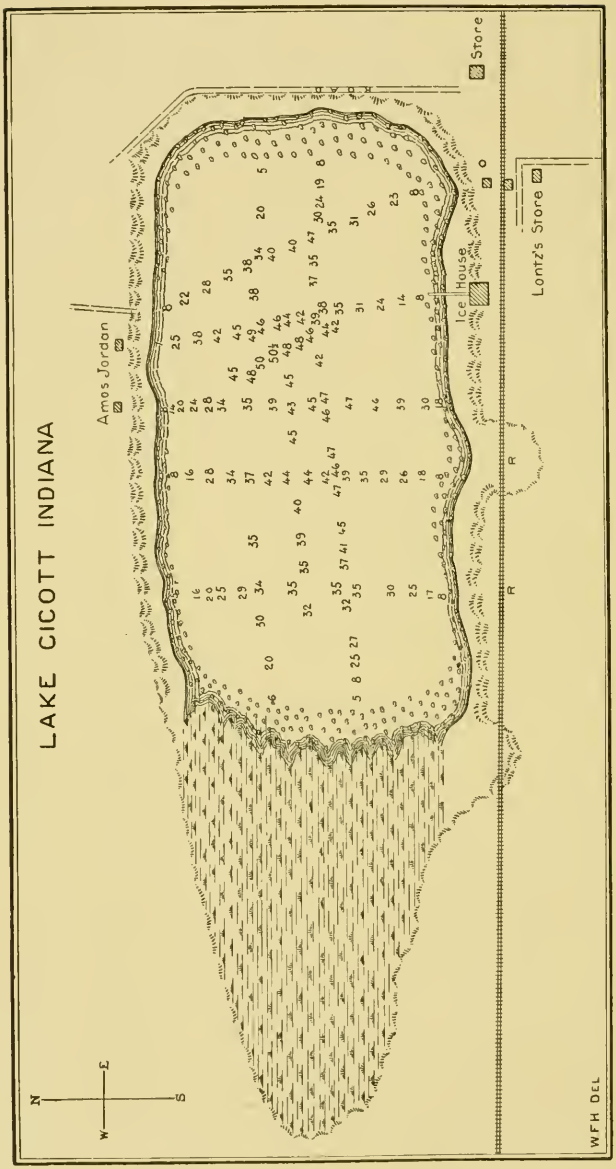
On October 20, 1900, the senior writer visited Lake Cicott for the purpose of learning something about its physical and biologic features. He was accompanied by Mr. John J. Hildebrandt of Logansport, who rendered valuable assistance in the study of the hydrography of the lake.

Lake Cicott is situated in the southwest corner of Cass County, Indiana, about 10 miles west of Logansport on the Effner branch of the Panhandle Railroad. The railroad station of Lake Cicott is a small place with 2 general stores, a small depot, water tank, and 10 to 15 residences.

This lake is of special interest because of the fact that it is the most southern of all that great group of glacial lakes so abundant in many of the counties in northern Indiana. Although the drift extends much farther south, nearly to Bloomington, Ind., and the ice-sheet doubtless extended nearly as far, no permanent lakes were formed so far south; indeed, Cass County seems to be the southern limit, and Lake Cicott is the only glacial lake in this county.

Lake Cicott is somewhat less than one-half mile long and about one-fourth mile wide. The major axis lies in a general east and west direction, the west end being a little farther north. The outline is quite regular, there being no strongly salient points or well-marked coves. The accompanying outline map shows fairly well the shape of the lake and other general features.

On the north and south sides the shores are of firm sand and clay, and rise quickly 10 to 25 feet above the surface of the lake, and are, therefore, high and dry, much like those of


LAKE CICOTT INDIANA
Amos Jordan
Ice House
Store
Lontz's Store
N
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Fletcher Lake (12 miles north of Logansport), and are covered with hard-wood trees.

At the west end is a long, marshy tract, several acres in extent, formerly all under water, but now simply marshy. It is said that it was much drier some years ago and much of it was cultivated in corn. This marsh is bounded by high ground, and doubtless represents the earlier and maximum extent of the lake in that direction.

At the east end the ground is dry, but only 4 or 5 feet above the lake and without any higher ground farther back. The lake now has no permanent outlet, but it is said at times to overflow at this end, the water finding its way eastward into Crooked Creek which flows into the Wabash River. Evidently the lake was formerly considerably larger that it now is; especially was it much longer than at present. The north and south limits have not greatly changed.

It is said that the water-level of the lake is a little higher now than it was a few years ago. Evidencing the probable truth of this belief is the presence of a clump of willows growing in the water 10 to 20 feet from shore in the southeast corner. A curious belief held by some inhabitants of the region is that the lake changes in seven-year cycles—that it rises for seven years, then falls for seven years; but data bearing on this question are lacking.

The lake is fed wholly by surface drainage, and, possibly, by springs. There are no streams flowing into it, and the catchment basin is not greatly larger than the area of the lake itself plus the marsh ground at its head.

While the shore entirely round the lake is dry and firm, except at the west end, there is in the edge of the water along the shore a strip of varying width of spatter-dock (*Nymphæa advena*), water-lily (*Castalia odorata*), water-shield (*Brasenia purpurea*), and a few pickerel weeds (*Pontederia cordata*); and mixed in with these is a dense growth of hornwort (*Ceratophyllum demersum*), water star-grass (*Heteranthera dubia*), a small amount of ditch moss (*Philotria canadensis*), *Chara*, a small amount of cattail (*Typha latifolia*), and various algæ. The bottom on which these plants grow in this lake is of soft muck. Somewhat farther out and in deeper water was considerable water milfoil (*Myriophyllum spicatum*), hornwort, and fine *Chara*.

The anchor or sounding lead brought up no vegetation from depths as great as 25 feet.

Depth.—Altogether 173 soundings were taken, with a specially constructed sounding reel with piano wire. Three east and west lines were run, a sounding being taken every 10 oar-strokes in the first two, and every 5 oar-strokes in the third line. Five approximately north and south lines were run and a sounding taken every 5 oar-strokes.

Line AB. From north of the middle of east end and running to near middle of west end. The wind being from the southeast, the boat tended constantly to drift toward the north shore; in consequence, this line has a somewhat northward curve. From lily-pads to lily-pads, 14 soundings were taken.

Depths: 5, 20, 34, 38, 49, 48, 43, 38, 36, 35, 34, 30, 20 and 6.

Line CD. Beginning at west end about one-third distance from south side and ending near middle of east end. This line also curves somewhat to the northward. Soundings were at briefer intervals.

Depths: 5, 8, 25, 27, 30, 32, 34, 37, 41, 45, 46, 47, 46, 47, 47, 47, 47, 46, 42, 41, 39, 38, 37, 35, 33, 30, 24, 19 and 8.

Line EF. From west to east through middle of lake. Twenty soundings, one every 5 oar-strokes, and only through the deep water.

Depths: 32, 33, 35, 35, 37, 39, 40, 40, 40, 41, 42, 44, 45, 45, 43, 44, 45, 47, 48 and 44 (this last taken twice).

Line GH. From railroad water tank northwest to the Amos Jordan house. The wind tended to drift the boat west of the direct line. Thirteen soundings.

Depths: 8, 23, 26, 31, 35, 47, 40, 40, 38, 35, 28, 22 and 8, every 5 oar-strokes from lily-pads to lily-pads.

Line IJ. From ice-house chute northward toward the Jordan house, 14 soundings, every 5 oar-strokes, from lily-pads to lily-pads.

Depths: 8, 14, 24, 31, 35, 38, 42, 46, 46, 45, 42, 38, 25 and 7.

Line KL. From Jordan's barn, straight to south shore, 24 soundings.

Depths: 8, 14, 20, 24, 28, 34, 34, 35, 37, 39, 42, 43, 45, 46, 46, 47, 46, 46, 44, 39, 35, 30, 18 and 6.

Line MN. From south shore northward in line with fence west of Jordan's barn, 15 soundings.

Depths: 8, 18, 26, 29, 35, 39, 42, 44, 44, 42, 37, 34, 28, 16 and 8.

Line OP. From north shore near tallest sycamore, southward to west end of largest clump of willows, 27 soundings.

Depths: 5, 6, 16, 20, 25, 27, 29, 33, 35, 35, 35, 35, 35, 35, 35, 35, 35, 35, 32, 32, 30, 27, 25, 21, 17 and 8.

Line QR. This is a series of 15 miscellaneous soundings in the deepest part of the lake and about on a line between Jordan's barn and the middle of the ice-house starting about $\frac{1}{8}$ distance across the lake from north shore and sounding every 5 oar-strokes or closer.

Depths: 45, 46, $47\frac{3}{4}$, 50, 50, 50, $50\frac{1}{2}$, 49, 48, 48, 48, 46, 44, 44 and 42.

From the above it appears probable that the greatest depth is about 50 feet. It is not likely that a much greater depth than this can be found, and 51 feet may, therefore, be put down as the maximum depth of Lake Cicott. It is said by some people of the neighborhood that the lake is bottomless, and that recently it was sounded with a 400-foot line and no bottom was found! Others say that bottom was found at 80 feet, and still others at 60 or 65 feet.

It will be noticed that the depth increases very rapidly from shore out and that the depth is pretty uniform in the middle of the lake.

There is very little clean sand or gravel anywhere; up to 20 or 25 feet the bottom seems to be pretty well covered with *Chara*, *Myriophyllum*, etc., beyond which it is of soft muck.

Temperatures.—A vertical series of temperature readings was taken at the last sounding on line EF (depth 44 feet), with the following results:

Depths in feet . . .	surface	5	10	15	20	25	30	35	40	44
Temperatures . . .	61.8°	61.5°	61.5°	61.5°	61.5°	53.2°	48°	45°	44.2°	44.2°

The bottom temperature was also taken at the fourth station

of line QR, depth 50 feet, and found to be 44°. This low temperature is interesting. It shows that the bottom of Lake Cicott was colder than Fletcher Lake, the lowest temperature of which was 47°, and was 7.5° colder than the bottom of Lake Maxinkuckee at 88 feet, taken about the same date.

Fishes.—The following species of fishes are known to occur in this lake. Very little collecting was done and the list is, of course, incomplete:

1. Yellow Cat, *Ameiurus natalis.* Not rare.
2. Bullhead, *Ameiurus nebulosus.* Not rare.
3. Grass Pike, *Esox vermiculatus.* Not rare.
4. Top Minnow, *Fundulus dispar.* Common.
5. Calico Bass, *Pomoxis sparoides.* Not common.
6. Bluegill, *Lepomis pallidus.* Common.

Yellow perch,* rock bass, large-mouth black bass* and small-mouth black bass were said not to occur here.

* The investigations made at the time of this visit led the writer to recommend that this lake be stocked with large-mouth black bass. The Bureau of Fisheries placed 400 of that species in the lake in the fall of 1902, and the stocking has proved very successful. Under date of May 11, 1908, Mr. John J. Hildebrandt, of Logansport, writes that bass are now very abundant in this lake and that some of very large size have been taken, among them one weighing 5½ pounds.

It is believed that the yellow perch also would do well in this lake and its introduction has been recommended.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NEW GENERA AND SPECIES OF CRINOIDS.

BY AUSTIN H. CLARK.

Through the kindness of my friend Dr. Th. Mortensen, I have been enabled to examine the large and exceedingly interesting collection of recent crinoids belonging to the University of Copenhagen, Denmark. Aside from its importance in shedding considerable light upon the species inhabiting the Indo-Pacific–Japanese region, and showing, from the large number of forms taken at a single locality (Singapore), how very rich this region really is, the collection is of great interest in including many specimens bearing the MS. names of Professor C. F. Lütken, names which have been more or less of a puzzle to students of the group, for, although many of them have crept into the literature, and several of them have been identified by Dr. P. H. Carpenter and Dr. C. Hartlaub, there still remain a number which have never been identified with any described species, and which were never diagnosed by Professor Lütken.

Dr. Carpenter and Dr. Hartlaub were apparently unaware that any of these names had been published; but in the lists of crinoids given in the catalogue of the Museum Godeffroy in Hamburg most of these names occur as *nomina nuda*, with a locality attached. Unfortunately, but few volumes of this catalogue are to be found in America; I have been able to consult Vol. IV, and part of Vol. V; Mr. W. K. Fisher has very kindly furnished me with the data from the remainder of Vol. V. Dr. Mortensen wrote to Professor Pfeffer at Hamburg for information in regard to the other volumes, which he courteously supplied, so that I believe we are now correctly informed as to the place of publication, and the identification, of all of Professor Lütken's nominal species.

Mainly from the results of the investigations carried on by the United States Fisheries steamer *Albatross*, and by Mr. Alan Owston, of Yokohama, in his yacht the *Golden Hind*, sixty-two comatulids are already known from southern Japan, and eight more from the northern part of that country, making seventy in all. In spite of this seemingly long list, I recently hazarded a remark that there probably were yet many crinoids in those waters of which we had no knowledge; and the occurrence, in this collection, of six additional species from Japan shows that my suspicions were well founded.

The species of *Himerometra* described, excepting *H. grandis*, all belong to that group of the genus comprising such species as *H. milberti*, *H. anceps*, and *H. variipinna*, in which the rays are in apposition, often more or less flattened laterally, and the middle and distal brachials are exceedingly short and oblong.

In the following diagnoses the number of the cirri is given in Roman numerals, the number of their component joints (exclusive of the terminal claw) in Arabic; thus (under *Comanthus decameros*) "Cirri XL, 16–17" signifies that the species has forty cirri, each of sixteen or seventeen joints. In designating the pinnules, the distichal (II Br) pinnule is represented as P_D, the palmar pinnule as P_P, the post-palmar pinnule as P_{PP}; pinnules of the outer side of the arm are referred to by Arabic numerals; thus P_1 is the pinnule of the second brachial, P_2 that of the fifth, P_3 that of the seventh, etc.; italics denote pinnules on the inner side of the arm, P_a being the pinnule of the fourth brachial, P_b that of the sixth, P_c that of the eighth, etc.

I have, as before, followed Dr. F. A. Bather's suggestion in regard to brachials united by syzygy, considering them as two separate brachials, not as a single one "with a syzygy," as was done by Carpenter and Hartlaub.

Detailed discussion of the species herein described is reserved for the completed report on the collection, now in preparation.

Family COMASTERIDÆ.

Genus COMANTHUS A. H. Clark.

Comanthus intricata (Lütken MS.) sp. nov.

Actinometra intricata Lütken MS. (part).*

* Not *Actinometra intricata* Lütken, Mus. Godeffr. Cat. V, p. 190, 1874, and following authors, which is the *Comatula rotalaria* of Lamarck, 1816, of which the *Alecto parvicirra* of Müller, 1841, is a synonym.

Centro-dorsal a very thin pentagonal plate, scarcely raised above the surface of the radials; three of the basal joints of a single cirrus remain.

Arm bases united to, and including, the first distichal, but well separated from that point onward; distichals, palmars, and post-palmars (five of the last are present) 4 (3+4); a single distichal series and three palmar series 2. Forty-five arms 195mm. long, of short triangular or wedge-shaped joints, over twice as broad as long, with everted distal ends.

Lower pinnules not especially long or stout; P_D 23mm.–25mm. long with about sixty joints; P_P 20mm. long; P_1 17mm. long; P_2 10mm. long.

Color (in spirits).—Dark brown.

Type locality.—Bowen, Queensland.

Type, in the collection of the University of Copenhagen.

Comanthus decameros sp. nov.

Centro-dorsal discoidal, bearing numerous marginal cirri in roughly three irregular and crowded, more or less alternating rows.

Cirri XL, 16–17, 20mm. long; first joint very short, second slightly longer than broad to about twice as long as broad, the third to the sixth two and one-half to three times as long as broad, then decreasing in length, the last two joints being squarish; opposing spine represented by a low tubercle; terminal claw about as long as penultimate joint, moderately stout, and moderately curved.

Ends of basal rays very prominent in the angles of the calyx; radials concealed; first costals short, oblong, widely free laterally; costal axillaries broadly pentagonal, about twice as broad as long. Ten arms 125mm. long; first seven or eight brachials slightly wedge-shaped, then triangular, about as long as broad; in the outer portion of the arms the brachials have projecting and finely spinous distal ends. Syzygies occur between the third and fourth brachials, again between the thirteenth and fourteenth to seventeenth and eighteenth (usually nearer the former), and distally at intervals of three to five (usually three or four) oblique muscular articulations. The arms are rugged and tubercular basally, but are not enlarged or swollen.

P_1 23mm., P_2 20mm., P_3 15mm., and P_4 10mm. in length, the last with a genital gland; the following pinnules increase gradually in length, reaching 22mm. distally. The distal dorsal end of the proximal pinnule joints of the lower four or five pinnule pairs is prominent, giving these pinnules a serrate dorsal outline basally; the distal ends of all the pinnule joints are projecting and finely spinous. The teeth on the terminal comb on the proximal pinnules are low and rounded; the comb is not found after P_3.

Color (in spirits).—Brownish yellow, the cirri lighter, the perisome darker.

Type locality.—32° 22′ N. lat., 128° 42′ E. long., off the Goto Islands, near Nagasaki, Japan; 170 fathoms.

Type, in the collection of the University of Copenhagen.

The only species with which this could be confused is *C. cumingii* of the East Indies; but the large number of long cirri with comparatively numer-

ous joints, and the absence of the swollen condition in the basal portion of the arms distinguish it at once.

Family HIMEROMETRIDÆ.

Genus HIMEROMETRA A. H. Clark.

Himerometra grandis sp. nov.

Centro-dorsal thick-discoidal, a rather small polar area bare; cirrus sockets arranged in two or three crowded marginal rows.

Cirri XXIV, 31–38 (usually 32–36), 30mm. long, rather stout; the eighth to the tenth joints are squarish, the remainder not so long as broad; from the eleventh onward sharp carinations are developed which may take the form of small spines; opposing spine centrally or subterminally situated, but short, not reaching one-half the diameter of the penultimate joint in height; terminal claw somewhat longer than the penultimate joint, rather abruptly curved.

Rays and division series as in *H. regalis*, to which this species is most closely related, but post-palmars are developed exteriorly. Forty-five arms 110mm. long, resembling those of *H. regalis*.

Proximal pinnules more slender than those of *H. regalis;* P_1 about 10mm. long, with twenty-six to thirty joints, slender and flagellate; P_2 and P_3 20mm. long, slender, though stiffer than P_1 with, in P_2 twenty-six to thirty, in P_3 twenty to twenty-five joints, the third squarish, after the fifth rather over twice as long as broad; P_4 9mm. long, more slender than P_1; distal pinnules 10mm. long.

Color (in spirits).—Reddish brown.

Type locality.—33° 10′ N. lat., 129° 18′ E. long., Hirado Straits, Japan; 40 fathoms.

Type, in the collection of the University of Copenhagen.

Himerometra molleri (Lütken MS.) sp. nov.

Alecto mölleri Lütken MS.

Centro-dorsal thick-discoidal, with a moderately large flat polar area, the marginal cirri in one and a partial second irregular row.

Cirri XVI, 34–37, 20mm. long, moderately stout, all the joints subequal, about twice as broad as long, very slightly shorter basally, very slightly longer distally, the sixth and following bearing small sharp-pointed median dorsal spines; opposing spine rising from entire dorsal surface of penultimate joint, blunt, not reaching in height one-third the diameter of that joint, the apex median or sub-terminal in position; terminal claw longer than penultimate joint, stout, slightly curved.

Costals and lower brachials deep, in close apposition, laterally flattened ("wall-sided"); brachials as in *H. milberti;* synarthrial tubercles prominent, but small; ten arms about 115mm. long.

P_1 10mm. long, slender, flagellate, with eighteen joints; P_2 15mm. long, much stouter, with twenty-one joints, the first two not quite so long as

broad, the third squarish, the remainder half again as long as broad; P'_3 11mm. long, resembling P'_2, though slightly more slender; P_4 9mm. long, slightly more slender than P_3; P_5 and following pinnules 9mm. long, very slender, and flagellate distally; the distal pinnules are 12mm. long.

Type locality.—"Indian Ocean."

Type, in the collection of the University of Copenhagen. Another specimen in the same collection was taken in the Straits of Malacca.

Himerometra schlegelii (Lütken MS.) sp. nov.

Alecto schlegelii Lütken MS.

Centro-dorsal thick-discoidal, the polar area thickly covered with small low flattened tubercles, bearing two closely crowded alternating rows of cirrus sockets.

Cirri xv, 26–35 (usually 30–35), about 20mm. long; first joint short, second about twice as broad as long, third slightly longer, fourth squarish; following to the twelfth or fourteenth squarish (some of the more proximal occasionally slightly longer than broad), the length then very gradually diminishing, so that the terminal joints are about one third broader than long; from the twelfth joint onward comparatively long sharp dorsal spines are developed; opposing spine considerably longer than the spines on the few preceding joints, about equal to the diameter of the penultimate joint in length, and rather slender, abruptly curved basally, but nearly straight in its distal half.

Radials projecting slightly beyond the edge of the centro-dorsal; first costals oblong, three or four times as broad as long, the lateral edges swollen into an elongate tubercle, and in close apposition; costal axillaries broadly pentagonal, about twice as broad as long, in lateral apposition; distichals (when present) 4 (3+4). Ten to thirteen arms about 70mm. long; first brachial short, slightly longer outwardly than inwardly, interiorly united for about two-thirds of their length; second brachial somewhat larger and irregularly quadrate, rising to a rather prominent tubercle with the first brachial, resembling that between the costals; third and fourth brachials (syzygial pair) about as long as the second brachial (three times as broad as long), oblong; following six brachials oblong, about three times as broad as long, then becoming wedge-shaped or almost triangular, gradually becoming oblong again and decreasing in length, the joints in the distal half of the arm being extremely short and discoidal, with projecting distal edges. Syzygies occur usually between the third and fourth (once between the fourth and fifth) brachials, again between the eleventh and twelfth to seventeenth and eighteenth (with occasionally an additional one between the ninth and tenth), and distally, in one specimen at intervals of nine or ten, in the other of eleven to twenty-five oblique muscular articulations.

The costals and first two brachials are in close apposition, and are laterally flattened.

P_1 about 5mm. long, comparatively slender, tapering evenly from

the base to the delicate tip, with about eighteen joints, all of which are practically squarish; P_2 about 7.5mm. long, slightly stouter than P_1, but slender and delicate distally, with about eighteen joints of which the first two are not quite so long as broad, the next two are squarish, the remainder gradually becoming elongated and about twice as long as broad distally; P_3 about ½mm. longer than P_2, stouter and stiffer, though the joints are in the same number and proportion; P_4 resembling P_3, but shorter and somewhat less stout, with about twelve joints, of which the first two or three are not quite so long as broad, the following squarish, becoming rather longer than broad distally; distally the pinnules slowly increase in length and become more slender; the distal pinnules are 6mm. long, moderately slender, with about twenty joints, the first not so long as broad, the second squarish, the following becoming gradually longer, reaching a length of about twice the breadth distally.

Color (in spirits).—Dull flesh-color, the perisome brown.

Type locality.—Japan.

Type, in the collection of the University of Copenhagen.

Himerometra producta sp. nov.

Centro-dorsal low-hemispherical, almost discoidal, bearing cirri in two crowded alternating rows; polar area moderate in size, with a raised and roughened center, surrounded by one or two rows of more or less obliterated cirrus sockets.

Cirri xvi, 24–26, 15mm. long, slender; first three joints very short, fourth not quite twice as broad as long, fifth to eighth half again as long as broad, then decreasing in length, after the tenth or eleventh being about as long as broad; ninth and following joints sharply carinate, on some of the cirri bearing small sub-terminal dorsal spines; opposing spine terminal, rather large, arising from the whole dorsal surface of the penultimate joint, its anterior edge being a continuation in a straight line of the distal edge of the penultimate joint; terminal claw somewhat longer than the penultimate joint, rather slender, moderately curved.

Radials short, their dorsal sides parallel to the dorso ventral axis of the animal; first costals very short, four or five times as broad as long; costal axillaries broadly pentagonal, rather over twice as broad as long, rising to a slight, smooth, rounded tubercle with the first costal; three distichal series present in the type, all 4 (3+4). Thirteen arms 50mm. long; first two brachials wedge-shaped; next six oblong, three or four times as broad as long, then short wedge-shaped, becoming oblong again and very short after about the middle of the arm.

P_1 slender, flagellate distally, 5mm. long, with seventeen to twenty joints, the first not so long as broad, the second to the fifth squarish, then becoming elongated, and about twice as long as broad distally; the first seven or eight joints somewhat carinate; P_2 similar to P_1, 7mm. long; the distal joints are somewhat longer, and the carination of the lower joints is more marked; in addition to the dorsal carination there is a lateral carination (only slightly marked on P_1) especially evident toward

the end of each joint; P_3 comparatively stout and stiff, 8mm. long, with twelve joints, the first not quite so long as broad, the second squarish, the following becoming elongated, and about three times as long as broad distally; the second to the fifth joints have a sharp dorsal keel, and from the third onward the median portion of the exterior surface of the distal end of the joints is produced, forming a moderate "lateral process," as described by Carpenter in *H. variipinna;* this is repeated, though not so strongly, on the opposite side of the pinnule; in the distal portion the entire distal end of the joints is somewhat overlapping; P_4 and following pinnules 4mm. long, with twelve joints, increasing in length to the third, which is squarish, then increasing distally to about three times as long as broad, the three or four terminal joints shorter again. The distal pinnules are 6mm. long.

Color (in spirits).—Flesh color, clouded with violet.

Type locality.—Singapore.

Type, in the collection of the University of Copenhagen.

Himerometra ensifer sp. nov.

Centro-dorsal thick-discoidal, the cirrus sockets arranged in two closely crowded, irregular, more or less alternating rows.

Cirri xv–xx, 30, 20mm.–25mm. long; first joint very short, the following gradually increasing to the sixth, which is squarish; next five or six joints slightly longer than broad, the length then very gradually decreasing, the distal joints being about one-third broader than long; tenth and following joints with well developed dorsal spines; opposing spine and terminal claw as in *H. schlegelii.*

Disk completely covered with a pavement of small plates.

Arms as in *H. discoidea;* but the synarthrial tubercles are produced extravagantly, as in *Perometra diomedeæ*, giving the animal a very characteristic appearance.

All the proximal pinnules have squarish joints; P_1 is 7mm. long, very slender, with 20 joints; P_2 is 7mm. long, stouter than P_1, with 17 joints; P_3 is similar to P_2, but is only 5mm. long, with 16 joints; P_4 and the following pinnules are less stout than P_2 and P_3 (though stouter than P_1), 5mm. long, with 13 joints.

The ten arms are 80mm. long.

Color (in spirits).—Nearly white to dark brown, the perisome darker; the cirri of the lighter specimens are usually purplish.

Type locality.—Singapore.

Type, in the collection of the University of Copenhagen.

Genus CYLLOMETRA A. H. Clark.

Cyllometra anomala sp. nov.

Centro-dorsal a thick disk with a broad, slightly concave, polar area, the cirrus sockets arranged in two irregular, crowded, more or less alternating rows.

Cirri XXX, 21–28 (usually about 25), 10mm.–12mm. long; first six or eight joints not so long as broad, the remainder squarish; dorsal surface of the joints smooth, rarely in the terminal two or three with a slight trace of a minute central tubercle; opposing spine prominent, though small, reaching to not more than about one-third the diameter of the penultimate joint in length; terminal claw rather longer than the penultimate joint, moderately curved.

Radials concealed by the centro-dorsal; first costals slightly trapezoidal, very short, four times, or rather more, as broad as long; costal axillaries about half again as broad as long, and, like the first costals, free laterally; seven distichal series are present, one of 2, the remainder of 4 joints with a synarthry between the first and second and third and fourth;* the second distichal, except when axillary, always bears a pinnule; there are three palmar series of 2, of which the second is not an axillary, these being, therefore, strictly homologous with the distichal series in *Uintacrinus*, and in the abnormal specimen of *Heliometra tanneri* which I described not long ago.† Seventeen arms about 55mm. long, resembling those of *C. manca* or *C. albopurpurea;* the pinnule of the fourth (epizygal) brachial is present on about half of the arms.

Color (in spirits).—White, the cirri with narrow bands of light purple, the polar area of the centro-dorsal deep purple, the division series and discoidal lower brachials with a median line of purple, the remainder of the arms crossed by purple bands about equal to one brachial in width, separated by white bands of the same width.

Type locality.—Off Nipon, Japan.

Type, in the collection of the University of Copenhagen.

GENUS OLIGOMETRA A. H. Clark.

Oligometra pulchella sp. nov.

This is a delicate and rather slender species, similar in general build to *O. gracilicirra* from the Philippine Islands, though the cirri are proportionately only one-half as long, with about half as many joints.

Centro-dorsal discoidal, the large polar area circular, flat, and unmarked; cirrus sockets in a single marginal row.

Cirri XIV, 16–23 (usually about 18), 7mm. long, comparatively slender; first joint short, the following gradually increasing in length to the sixth, which, with those following, is squarish; fourth and following joints with a low transverse ridge extending entirely across the flattened dorsal surface of the joints, in the earlier joints subterminal in position, at about the eighth becoming median; this ridge is finely spinous, and appears as a very small dorsal spine in lateral view; opposing spine delicate, median

* This is an entirely new type of arm structure; in all other cases where the distichals are four in number, the two outer are united by syzygy. I have already pointed out, however (Proc. U. S. Nat. Mus., XXXV, p. 127, 1908), that this syzygy was in reality occupying the position of a synarthry, though I did not then know of any species with this more primitive type of arm-structure.

† Proc. U. S. Nat. Mus., XXXIV, p. 267, fig. 4.

in position, standing out vertically from the dorsal surface of the penultimate joint, not reaching quite half the diameter of that joint in length; terminal claw rather longer than the penultimate joint, stout, and strongly curved.

Radials even with the edge of the centro-dorsal; first costals short, four or five times as broad as their median length, not united, the lateral edges straight; costal axillaries triangular, about twice as broad as long, rising to a rather prominent median tubercle with the first costals. Ten slender arms about 60mm. long; first brachial short, wedge-shaped, about twice as long outwardly as inwardly, inwardly united for about the proximal half, the distal free edges diverging at rather more than a right angle; second brachial similar in shape, but slightly larger, rising in the proximal median line to a moderate tubercle with the first; third and fourth brachials (syzygial pair) slightly longer inwardly than outwardly, about twice as broad as the longer lateral length; four following brachials oblong, rather over three times as broad as long; second syzygial pair wedge-shaped; following brachials triangular, not so long as broad, later becoming wedge-shaped, broader than long, and, in the terminal portion of the arm, as long as, or even longer than, broad. After about the tenth the brachials have rather strongly produced and overlapping, finely serrate, distal edges, giving the arm a characteristically rough appearance; this begins to die away in the outer half of the arm, and disappears in the distal third. Syzygies occur between the third and fourth brachials, again between the ninth and tenth (rarely the tenth and eleventh), fourteenth and fifteenth to seventeenth and eighteenth, and distally at intervals of five to eight (usually five) oblique muscular articulations.

P_1 about 4mm. long, moderately slender, tapering evenly from the base to the tip, with sixteen joints, of which the first two or three are not quite so long as broad, the remainder squarish; in its outer half the pinnule becomes styliform and then flattened; the last ten joints have their distal dorsal ends much produced, so that the dorsal outline of the distal third (or rather more) of the pinnule is very strongly serrate; P_2 about 6mm. long, much stouter than P_1, much the largest pinnule on the arm, with about nineteen joints, the first two not quite so long as broad, the remainder approximately squarish; after the third joint the pinnule gradually becomes sharply styliform, the distal dorsal end of the joints projecting in a rounded, laterally flattened tubercle, which soon becomes very prominent; the base of this tubercle gradually involves more and more of the dorsal side of the joints, in the last ten or twelve arising from the whole dorsal surface, so that the terminal half of the pinnule, like the distal third of the first, is deeply scalloped in lateral view; P_3 about as large basally as P_1, but shorter (3.5mm.) with twelve joints, the first three not quite so long as broad, the fourth squarish, the remainder becoming gradually longer than broad, in the terminal portion about twice as long as broad; beyond the third joint the pinnule becomes rounded-triangular, and the distal dorsal end of the joints is prominent, though not excessively produced; P_4 slightly smaller and more delicate with about the same number of joints, which are proportionately longer

distally; following pinnules similar, but gradually becoming longer and more slender, with longer joints; the rounded-triangular condition of the distal portion of the pinnules is traceable to about the end of the proximal third of the arm; distal pinnules about 5.5mm. long, exceedingly slender, with about twenty joints, the first trapezoidal, about twice as broad as long, the second trapezoidal, about as long as broad proximally, the third slightly longer than broad, the remainder elongated with swollen articulations, distally three times as long as broad or even somewhat longer.

Color (in spirits).—White, with small bands and patches of light brown on the arms, the distal half of the cirri becoming brownish; or, white, similarly marked with deep violet; or, entirely deep purple, sometimes with the two proximal pinnule pairs white; occasionally, brown; small specimens are yellow.

Type locality.—Singapore.

Type, in the collection of the University of Copenhagen.

Oligometra imbricata sp. nov.

Antedon cupuliferus var. Lütken MS.

Centro-dorsal rather large, discoidal, with a large concave polar area, the cirrus sockets in a single marginal row.

Cirri XVI–XVII, 23–28 (usually 24–26), about 12mm. long; all the joints but the terminal five or six (which are squarish) are broader than long, the basal very much so; they have prominent distal dorsal ends, showing a tendency to rise into a low transverse ridge; the dorsal surface of the joints is flattened; in the outer part of the cirrus a more distinct transverse ridge is found, which gradually becomes narrower, at the same time gaining in height, so that the last six or seven joints have minute median dorsal spines; opposing spine prominent, but slender, not reaching quite the diameter of the penultimate joint in length; terminal claw longer than the penultimate joint, strongly curved basally, but becoming nearly straight distally.

Radials even with the centro-dorsal; the costals and brachials have about the same proportions as those of *O. pulchella*, and the synarthrial tubercles are about as prominent as in that species, but the brachials have very strongly produced and overlapping distal edges.

P_2 much longer and stouter than P_1; the following pinnules decrease rapidly in size, remain uniform for some time, then slowly increase distally; the proximal joints of the lower pinnules may be more or less carinate, and the distal joints expand somewhat from the proximal to the distal end, giving the edge of the pinnule a serrated outline.

Color (in spirits).—Grayish brown, the perisome darker.

Type locality.—?Tranquebar, India.

Type, in the collection of the University of Copenhagen.

FAMILY TROPIOMETRIDÆ.

GENUS ASTEROMETRA A. H. Clark.

Asterometra lepida sp. nov.

Centro-dorsal rounded-conical, about as long as broad at the base, the cirrus sockets arranged in ten crowded, but regular, columns, of usually two each, two columns to each radial area.

Cirri lacking, but, as the centro-dorsal and the cirrus sockets are proportionately smaller than in the three other species of the genus, it may be inferred that the cirri are either shorter, or more slender, or both.

Disk lacking; brachial and pinnule ambulacra protected by large covering plates as in the other species of the genus.

Radials short, about four times as broad as long, with a prominent tubercle in the median line; first costals oblong, approximately three times as broad as long; costal axillaries broadly pentagonal, not quite twice as broad as long; distichals 2, as in *A. macropoda* and *A. anthus*. Eleven arms (in the type) 70mm. long, resembling those of the other species of the genus, but somewhat more slender basally.

P_1 5.5mm. long, styliform, with ten joints, the first not quite so long as broad, the second slightly longer than broad, the third and following slightly longer than the second; P_2 6.5mm. long, with twelve joints, resembling P_1, and of the same diameter basally though, on account of its greater length, tapering more gradually; P_3 similar to P_2, with the same number of joints, but somewhat stouter; following pinnules gradually increasing in length and in number of joints, the joints in the terminal portion becoming proportionately more elongated; P_{10} is 9mm. long, and the distal pinnules are 12mm. long, with fifteen to seventeen joints, of which the first is about twice as broad as long, the second is squarish, the third about one-third longer than broad, and the following increasing very gradually in length, being distally about three times as long as broad.

Color (in spirits).—Brownish white.

Type locality.—Straits of Formosa; 35 fathoms.

Type, in the collection of the University of Copenhagen.

FAMILY ANTEDONIDÆ.

Mastigometra gen. nov.

Genotype.—Mastigometra flagellifera sp. nov.

Centro-dorsal hemispherical; cirri resembling those of *Antedon*, but much more numerous; arm structure as in *Antedon*; lower pinnules greatly elongated and exceedingly slender distally, P_1 twice as long as the cirri, P_3 and following pinnules about as long as the cirri.

Mastigometra flagellifera (Lütken MS.) sp. nov.

Centro-dorsal hemispherical, a rather small convex polar area bare.

Cirri I.–LXXX, 15, about 12mm. long; first two joints short, about twice as broad as long; third about one-third again as long as broad;

fourth and fifth the longest, about half again as long as broad; following joints decreasing gradually in length to the third from the end which is about one-third longer than broad, the last two being about half again as long as broad; opposing spine represented by a very small terminally situated tubercle, which may, however, be quite absent; fourth and fifth joints very slightly "dice-box shaped," but the remainder with almost straight edges; there is no indication of any dorsal spines. Up to about the sixth joint the cirri are rounded in cross section; from that point onward they are somewhat compressed, and appear somewhat broader in lateral view.

Radials even with the edge of the centro-dorsal; first costals very short, about five times as broad as long in the median line, narrowing rapidly anteriorly, not in apposition basally; costal axillaries triangular, about one and one-half times as broad as long, as broad basally as the distal end of the radials, and consequently overhanging on each side the narrow anterior end of the first costals. Ten arms probably about 120mm. long; first brachial very obliquely wedge-shaped or almost triangular, much longer exteriorly than interiorly, interiorly just in apposition basally, the free interior edges diverging practically in a straight line; second brachial irregularly quadrate, about as long as the outer edge of the first; first two brachials and second costal with a somewhat produced and thickened border; synarthrial articulation between the first two brachials and the costals rising to a moderate tubercle; third and fourth brachials (syzygial pair) about half again as long interiorly as exteriorly, and about one and one-half times the greater length in width; next four brachials oblong, about twice as broad as long, then becoming wedge-shaped, and after the second syzygy triangular, about twice as broad as long, later becoming wedge-shaped again and somewhat longer; distal portion of arms lacking; syzygies occur between the third and fourth, ninth and tenth, and fourteenth and fifteenth to sixteenth and seventeenth brachials, and distally at intervals of three to seven (usually three) oblique muscular articulations. The distal ends of the brachials after the first syzygy are rather prominent.

P_1 25mm. long, moderately thick at the base but gradually tapering and in the distal half very slender and flagellate, composed of forty joints, the first about as long as broad, then gradually increasing in length, the tenth and following being about half again as long as broad; first five joints slightly constricted centrally; P_2 16mm. long, similar to the first, but not so stout basally, with about thirty-five joints; P_3 10mm. or 12mm. long, about as stout basally as the second, but less slender and flagellate distally, tapering more evenly from the base to the tip, with twenty joints, resembling those of the first and second; it bears a long genital gland; P_4 and following pinnules similar; the genital gland disappears about P_{12}, after which the pinnules are about 15mm. long, exceedingly slender, with about thirty-five joints, the first short and crescentic, the second irregularly quadrate, about as long as its distal diameter, the third squarish, the remainder gradually increasing in length, being about twice as long as broad in the distal half.

Color (in spirits).—Brownish yellow.

Type, in the collection of the University of Copenhagen, from an unknown locality.

GENUS HELIOMETRA A. H. Clark.

Heliometra glacialis biarticulata sub. sp. nov.

Similar to typical *H. glacialis* from Labrador and Greenland, but the proximal joints of the lower pinnules are more strongly carinate, the cirri are more noticeably spiny, the brachials rather more overlapping, and the distal intersyzygial interval is three instead of four oblique muscular articulations.

The longest cirri are about 50mm long, with 60–70 joints; the arms are somewhat over 150mm. long.

P_1 27mm. long, with sixty short joints, the distal half rather prominently serrate; P_2 similar, and of the same length; P_3 25mm. long, all the joints proportionately slightly longer, most of them being about half again as long as wide, and the distal portion not serrate; P_4 17mm. long, with twenty-six joints, the first six squarish, then gradually becoming elongate, and about twice as long as broad distally; this pinnule is stouter than the preceding, and, while tapering evenly to the tip, is not flagellate.

Color (in spirits).—Light yellow.

Type locality.—?Straits of Tsugaru, between Hokkaido and Honshu, Japan.

Type, in the collection of the University of Copenhagen.

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